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machines and men. I tree drains on the proms of industry are enormous, the power loss alone amounting to a considerable item. Skayef self-aligning ball-bearing hangers prevent approximately 60 per cent of the power loss in line shafting and are not subject to heating and wear which enforce shutdowns for bearing adjustments and replacement.

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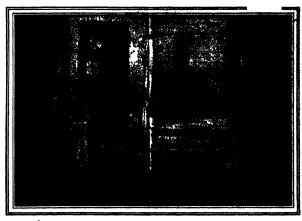


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Chin Falos St. a.B Rotter Pales St. 200

With the Editors

UB globe-tretting member has been very bear ever fates his return, and very bear ever states his return, and very bear ever states his return, and very bear ever a guestion about this provide experience. He has had little time to record for the proper state that the state of the proper state him about the would otherwise have are submered in the continued humble which represents his present recordentous of a wind and Beetlu and Runtin and Eurith and Runtin and Eurith and Beetlu and Runtin and Eurith and see in Munich, and the other states and seek to which two were spent in Beetlu and one in Munich, and the other treatment of the state of t

Sermency across neutral frontiers. A "Own our pichocrutting number had a varied unpleasantness; and this was confirmed on inquity at the Barwau of Information in the Gare du Nord, at Paris. In response to his request to be informed into the Gare du Nord, at Paris. In response to this request to be informed into the confirmed on the Gare du Nord, at Paris. In response to this request to be informed into the confirmed in the result of the confirmed in the confirm

If it estimated thousand-mark notes with a larvah hand among the parters and the larvah hand among the parters and changing an incredible number of thousands of marks at the bank in Romans-horn for something life eight and a quarter of the larvah shaded of the larvah of the situation platform cost frame for some very useful information. The officer seemed to report him as a benefactor of the city, but the cities reful life a biggar that the larvah of the cities reful life a biggar than the cities reful life and the cities reful life and the cities reful life and the cities refull life and the cities of the cit the city, thit the centuriest was a bragain to descend to such a pality scale of tipping as a single unit of currency. He learned that one can travel for 15 hours, from Bertin to Mupich, for 80 cents—or proportionately more if one adopts the second or first class travel, which is more fitting for an American millionaire.

First stamp collector finds the Scinzerrato
A American offices quite predoctive of
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DEPARTMENTS

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UNDER the heading "Unprecedented Demand for Old Papers" appearing in the Beigntie American of 75 years ago, we read the following "At the com-mencement of the present volume of the SCIENTIFIC AMERICAN We had nearly one schemistic America we had nearly one thousand complete sets of the preceding volume on hand. Since that time we have laid five hundred copies of those sets bound, and the balance have been ordered by mail and sent in sheets. We are now bound, and the calunce have been ordered by mall and sent in sheets. We are now obliged to inform our patrons we are unable any longer to furnish complete sets in sheets, and we have but fifty more hound copies left Little wonder that the early bound copies of the BURNTIFIC AMERICAN are so scarce in our day

A FTFR an extensive investigation into the hours shortage situation, we have come into possession of considerable first-hand information on that very important question—are present-day houses properly built? Our lavestigator has gone out on the jobs limself, clusted with the carpenters and massens, called on the lumber companies, consulted building inspectors, companies, consulted building inspectors, and in every other way gathered first hand impressions. It appears that a large proportion of the houses now being con-structed throughout the country are being honestly and lastingly built. New methods honestly and lastingly built. New methods of construction are being introduced to offset the high cost of materials and labor, and many of these new methods have much to commend them. It is a mistaken idea that we must forever construct houses as in the days of our forefathers, when as in the days of our forefathers, when lumber was the main material employed and it could be used with a lavish hand because of its low cost. On the other hand, there is a good deal of hurried, careless and cheap work going into many houses. Too often the builder, after he houses. Too often the builder, after he has received his payment, does not care how shabby a house will become. And the worst feature of the situation is that the average, bouse buyer is quite unfamiliar with building materials and nuthods and judges his purchase merely by apparamees. Obviously it is difficult to unshuffle the bad from the good for to unshuffle the bad from the good for by the very nature of a house it is un-necessary purposely to cumouflage bad work. The walls, when completed, con-cent it. Our report on the situation will

A UNMOBILE statistics at a glance, in the form of simple graphic comparisons, the present state of radio development not only as regards the broadcasting ment not only as regards the broadcasting situation but more particularly the de-velopment of radio receiving equipment diamond mining in Colombia the applica-tion of carrier current communication to tion of carrier current communication to the broadcasting of music and talks over telephone lines and electric transmission systems, the magnitude of the canning industry with special reference to fruits and vegetables—these are but a few of the features of our forthcoming Angust issue which, we hope, will be more varied and more interesting than ever

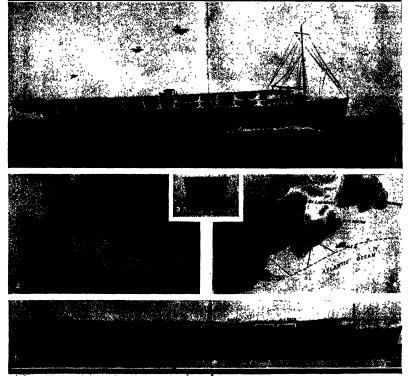


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SCIENTIFIC AMERICAN

THE MONTHLY-JOURNAL OF PRACTICAL INFORMATION

NEW YORK, JULY, 1923



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Trapping the Burglar

Clever Devices Put Forward by Inventive Genius for Catching the Proviler at His Work By Edward H. Smith

ARLY in 1863, His Highness, the bulse of Brumswick, hired a walet. As was his custom, the deposed Charles Frederick Augustus William exercised both care and caution in the choice of this new body servant He spont many weeks over the problem and finally settled upon one, Shaw, a Britisher who had apparently served several noble English houses and

apparently served several noise Engine notines and come away with the most glowing testimogials, all of which the ducal German had examined with anxious eyes. Show arrived in April, came to terms with his new master and was installed. The circumspection with which the duke moved was natural. On his delironement in 1830, he had removed to a great old house in root, as and removed to a great out nouse in Paris, carrying with him a treasure of about three million dollars in jewels and gold. His collection was famous and the refuger prince understood that he and his heard were the understood that he and his heard were objectives of constant plots among kuro-pean crooks. Accordingly, his Paris house was most strangely and marvelously fitted with defenses in the nature of spe-cial locks and bolts, iron doors, watchmen

and alarm contrivances. Every European inventor of new kinds of anti-burglar deinventor or new kinds of unti-nursiar devices found a ready customer in the duke, and certainly no house on the continent could show curious and ingenious defenses to match those to be found in the dural quarters.

to match indee to be round in the dural quarters. The store of jewels was kept in a huge iron safe of French or German manufacture, which stood in a spe-cially constructed above opening from the ducal bed-room—a refrest which might now be called a vault. This alcove was closed with a heavy iron door fitted This shows was closed with a heavy iron door fitted with pedicids to intricted design. Once this door sup-ger open, there stood the vast sars, again locked with the control of the control of the control of the terest here—defended by nor one but three set-gun arrangements. If any rada robber attempted to open the door of the ania velthout the proper keys and the firingers, he was certain to receive the fire of these foundable batteries of revolvers and slag gun-counts to dispatch an elephani entire to dispatch and the keys and only the understood the complete intriceries or his defenses.

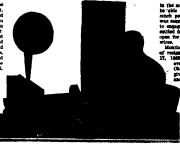
No one but the duke himself had the keys and only be understood the complete intricates on his defenses. As a rule, he permitted no one else to be present in his bedroom when he opsaced the doors of the vault and safe, as he did at intervals, either to gloat creer his he had not been as the safe of the sa

to his hoard. Shaw, the new valet, was to his hoard. Shaw, the new variet, was a notable British professional burgler His references had all been forged and the hyper-cautions Brunswick prince had fallen before a trick which still succeeds in outting criminals into the households in putting criminals into the hou of the rich

Shaw put in the first few mouths of his service getting the confidence of his muster, a thing not too lightly accomplis But once the fugitive princeling had been well begulied, he trusted Shaw even to the extent of admitting that he actually owned some jewelry and that it was some-where about the house. The servant had, to be sure, discovered the iron door of the vault on his first day in the house, ob-

walf on his first day in the bouss, ob-viously hidden as it was belind heavy we'ver portierss near the head of the bed.

If the head of the bed, as first opportunity for or-anization. When his resire had, gene out such the other servants were elevenbers, he 'drew sidde the por-tieres and inappeted the books of the walft door. Two of them, he saw, could be preited without great dis-termental than the servant of the same than the servant of the servant was the servant of the servant of the consequently satisficated case in procuring its law through confidences. This job was shortly accom-plished, and the next time the date left the house his



Even the radio telephone has been enlisted in running down the thief. Here is how the New York Police Department breadcasts an alarm to everyhely

valet promptly opened the vault door and behald the fearmone angect of the saits. Not only was it protected by the bettereds of shooting from, he found to his ser-prise, but it was electrically wired, susty the first produced by the bettered of shooting from, he found to his ser-prise, but it was electrically wired, susty the first can be dead of the said to be a subject to the said to be a successful to the said to

the matter of spigma mechanisms and And hoped is also to disconnect those of the Same spikers with the disconnect those of the Same spikers in the part disconnect through a Same this part disconnect and was local as acceptable, he had not despite. In the land the disconnect Same seek of the sam

aths passed without result and filter was thinking estating and returning to Lendon. On Jocomber 1908, however, for intempreted carriements of every reast played into his basels. The quarkyas give a certain lader a few levels to Canadram and had enumenced a leveller to consult with him about parting the gains into forms setting. Preparatory to the poldentities arrival, the duts opened har wattle and the door of the earth. Them he sat about, chaffag and waiting the contract of the contract as hour, the date impattently closed and locked the vault door without having taken the trouble to reclose the door of the ante and put his solvagues and starms into business order. So he quit the house, leaving a causic resempe for the jeweiter who was to be commanded to return that

Shaw, of course, seized the ge

erming.

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In the days of Losis XIV of France, can of the royal safets was acquipped with a bonh, transpared to explode in case the atreactors were forced open. Unhappily in brief up a francete several instead of the royal safety of the result of the principal safety of the royal safety is safety of the royal safety of the royal safety is safety of the royal safety of the royal safety of the royal safety is safety of the royal safety



A home-made set-gun for garage use, which would probably put a her upon the burglar's sureas

a miniature model of his it that disturbing a switch at one p bell situated elsowbers. No des was

bell strated electrons.

out being shows.

Fridently some Prench electricism had policy in
flar results a little later than the Assistant for
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entity dynamic of Egypt were probably as such constraint with there as with the denshitty of the entity dynamical holors. Eying probably built his present and probably built his probably and the treasures of his framers will applied introduce the entity of the entity

The pervasiveness of this problem in the minds of inventors of every period is only parallelled by the persistence of the robber Anv man possessing the dryne patience to run through the gastric of patients for the last 30 years, let us say, would be appalled by the number and variety of anti-nuglar devices. He

the number and variety of anti-nurgiar ceroes. Its would be covaled with laughter at many of the listed derices and stunned by the ingenuity and intricacy of neary others. A few samples will reveal enough Some years ago an inventor invaded the office of one of the largest burgiar alarm companies and presented his invention. It was a gitted or nickelled sittley of his invention. It was a gilided or nichelled affair or metal, wery like a huntilar-case watch and designed to be hung on a chain and alipped into the vest pocket opposite that containing the watch both the timplece and this mechanism being attached to the same chain at opposite med. Indeed this nearl contraption was trigger arrangement. If a pickpocket took hold or the chain and tirds to lift the watch off went the cartridge with a loud bang. Being enclosed in the metal case the exploding posite was not carpeted to set the user sheen, but one wooders what might have hopposed to the accross againstana who evasived into the wrong pessed on crowded subway trains when some "dip" get to work.

Another inventor developed a little mechanism based on the cap firing sticks used by children on the Fourth of July, with the difference that his cap shooter used or July, with the discretive that his cap sincore used, a spring and ringger first. A cord was run from the door knob to one end of the little device. Another cord connected the off end of the cup first with the wall If anyone opened the door there was an explosion, set ficient to frighten away any burghar ignorant enough not to know about the tow.

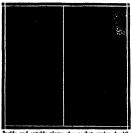
not to know about the tor
When I was much younger an inventor in the Middle
Week persuaded a local banker that he was in great
danges of being robbed by hold up mee, with the result
that a number of appeals tray doors were cut into the
Soor of the best just before the tellers' carees If a
hold-up man satered the tailer merely rouched a bottom
and the Soor yawred beneath the robber letting him
said the Soor yawred beneath the robber letting him and the moor yawness occurant the recomer setting and down into a beasurest, where he could be captured at leisure. Unhappity, the mechanism went away one bung Saturaly morning with the dire result that four valued depositors scoted into the oubliette, one of them suntaining a broken ley and another some sore bruisss. Damage switz and the immediate removal of

brpiese Damage settes and the immediate removal of this invention resulted Within the memory of most of us, the principle of the electric shall was experimentally applied to the autignaturing of safes and weaths, formerse thought up the idea of placing motal main all about earlies and then attaching both these mats and the ante tiged to a light voltage electric light circuit. We use to be



switches contribung such set in the mechanism just as the interference interference interference in the mechanism just as the interference in the media of the interference in the interferenc

To go into the matter of the starms which have been devised to keep thieves and burglars out of private delised to keep thieves and burgiars out of private houses and apartments would be to write a catalogue Catches on doors and windows which set off gongs by mechanical means are beinings the commonest. Every layoutive bot has fitted his father's house with something of the sort. Strings and cords stretched across rooms and spectures at night for the fumbling feet and rooms and aper tures at might for the funning red and hands of the burgier in the data have been almost an aumerous. When touched by an intruder such lines-released a trigger or pulled out an electric plug thereby setting a going into violent safration. This idea is still applied to some types of local going alarmos used in New



Inside and outside views of a pecket equipped with the latest device for keeping out the prying pick-pecket's fingers. The owner of the pecket gets in by pulling the string latch, as shown at the left

York City Devices for relocking windows and doors cartridge exploders rocket files whistle blowers elec-trified common screens for summer use when windows trifled common sevens for summer us, when values are open and nauv others need to be noted the corresp. I saw a house equipped with an nationate lamps and the control of t lighting

The weaknesses of all these plans are at once apparent to whoever has given the burgiary question over desultory attention. I there the mechanisms are more perilous to the user than to the oriminal or they are no results defeated by any higherned burgiar as to

render them worse than usefeets which appear in all siams systems and in all elve that is human there has been a constant quest for the unbeatable alarm— a cry after perfection Receies to say the im

possible is achieved every rain of some infatuated de brain of some infatuated de-signer. Not long ago an in-ventur approached the of ficials of a prominent alarm company with the modest statement that he had it at last. On investigation his



Another extremely deadly set gun of the sawed off shotgun type

invention proved to be a device attachable to telephones which would jiggle the receiver hook up and down tupidly in case any window or door lock were disturbed in the night thus flashing to the central operate message that a but her was on the premises. All the hello girl had to do was to summon the police. Was this not simplicity and effectiveness to the point of

purest beauty. It was—until the slarm man asked his friend what would happen if a burglar cut the wires Another and more dramatic incident of this sort happened to the same official. A very earnest voting man came in with a burglar alarm device of which the central instrument was a series of glass tubes, almost filled with liquid in which floated a cork transfixed by a copper wire. Liestrical contacts were placed fixed in a copper wire. Liestrical contacts were placed at the top and bottom of each the E. If the tubes or any one of filein were broken the liquid run out and the covic full to the bottom completing the circuit by means of his bit of copper wite and off went the air run I? on the other hand the place took first whether he heat of the rose in wealth sufficiently expand the liquid to runs-the cork to the top of the tube again closing the irecuit

and giving the slarm
You see send the young man I've certainly got it There s no way to beat it Is there He stared at the alarm companys officer with de-

flance in his eve Not unless you out the wire said the other

The inventor stiffened like a man shot rose out o lapsed in a dead faint. When he had been revived be took his invention ressed it contemptuously into his satchel and went away without a word Zenl betraved blu

I have spoken above of the persistent use of explo sives in burglar catching devices. The farmer's gun in the han coop is as indicated far from obsolete but sives in burgiar catching devices in the hen cosp is an indicated for fiven obsoicte but inventors have lately been offering through the regular market a specially designed mechanism for the shooting down of not turnal invaders. This consists of a simple mounting to be served to a deek table window sent or shelf. Yo this is attached a short shotgum berred of eight or ten inches in length designed to receive an ordinary 12 gage shell. Behind the barrel is a spring trigger arrangement which is to be attached to a wire stretched across the room and fastened either to a door stretched across the room and fastened either to a door or window or to the opposite wall the wire being drawn faut. The barrel of the gun is then aimed along hills on it turing the night or if an intruder stumper against the wire in the dark he is directly in the hills of fire and certain to receive the change of who washes in mechanism is efficience of course only when the

t methanism is affective of course only when the buildin is ignorant of its pressince. Its deadly nature will probably persuade many against if sethanic have in verbly loss played a dramatic part in the stories of many an American community as witness the case of Charles Adams of Chester, witness the case of claiming Admins of theser, ver-mont A number of varies ago this quict little com-munity suffered from what the reporters to eto call an relicting of burglaries. Shops factories private houses and even stables were entered at night and everything and a one stables were entered at talch and everything was stolen from a hen or be no if feed to half a merchant stock of cotoling. The tend pollen and the interest eithers tried every names: f. dodg, but causiff no one of imperiance. When special vialls were being top of dufing lapters operated the properties of the stable of the stabl

ague of intrusions was this man, Adams head of the heard of education supervisor of the public library ex legislator a bookish and studius man or old resident descended from locally distinguished an centers and prosperous if not wealth. He supplied the local virilantes with more ingral as plans for thief eatching than anyone cles in the town but the actual



Building the World's Largest Monolith

A Word Regarding the Far-Reaching Significance of Wilson Dam to Navigation and Industry

By Littell McClung

HE MOST significant effort in construction undertaken by the Government since build ing the Panuma (anal is the monolithic fashioning, of Wilson Dam across the Tennessee River at the foot of Muscle

Tennessee River at the foot of Muscle and Uniform Unif

The photographs reproduced herewith are the first showing the progress of the Government's effort. At present work is in five main divisions. I irst there are the lock chambers for navigation over the dam at the north end list beyond these rises the short non-overflow section. Across the two channels of the river and the listand between them extends the main spall way division. At the south end against high banks stands the half finished powerhouse on which construc-tion is rapidly joing forward. Diem driven into the thon is rapidly soing forward. Fiven driven into the with banks for a quarter of a mile will be the high

The two locks along the north side will have a lift of 45 feet 6 inches each. These locks like all the other equipment on Wilson Dam, will be electrically operated

by current from the gen erators Some idea of their musdveness may be gained from the fact that the lock gates will weigh 1500 tons and each of the 63 crest gates will weigh 81 toms Orders will soon be ced with large manu facturers for some of which Congress recently appropriated \$10 000 000 This cost is in addition to that for turbines generators and much of equipment When com-pleted Wilson Dam will be 5000 feet king 101 first wide at founda tims and will lift its superstructure nearly 125 feet above the river hed To bring into ex istence such a monolith

now sometimes reaction all phases of the work must be suctionized—drilling blasting and excavating bringing in materials for making concrete building pringing in materials for making concrete building flawless forms transporting concrete to these forms and the final pouring. To combildate these factors in a continuous manner requires 21 sulles of railroad two dosen loats and barges a number of electrical cranes scores of rock drills three huge crushing and mixing plants. 30 locomotives and more than 200 cers and

The effort is truly gigantic and in some phases quite spectacular both as to engineering and construction.

This may be realised when one considers that Wilson
Dam will contain almost three times as much masonry as the Roosevelt Dam in Arizona and that it will be 81 000 cubic rards larger than the Assouan Dam in Egypt-at present the giant among the world's river

There are few precedents to guide the various phases of the work for the reason that this is the most massive dam ever undertaken and because it is being built in dam over undertaken sind because it is being build; his a linessence sourcher where flessives may occur in the rock strain. While the general principles of gravity-the Panama Chaul is a problem unto itself and in an engineering sense a flascinating one-the first natural sensory to be check mated in upward presente—the upward furust of any water that may seep under the flaspidations. At the start, of course, the riverbed was exhaustively tested by diamond defin-ing and hydraulic pressure. Then the solid rock was

blasted out 16 feet deep across the stream. Into this channel the concrete Soundations of the dam were 'toed making them virtually monolithic with the

tood making them witnessly monoithle with the natural rock.
Throughout the length of the dam a tunnel is being contracted through the foundations close to the riverbed. From this tunnel witness the first of the contract of

manenty sealing them from the most interesting work is that on the great powerhouse that will be 1184 feet long. The day the accompanying photographs were taken, workmen the accompanying photographs were taken, workmen the season of the first possions. The rolumes of water that will surge through these peastocks to the turbine may be envisioned when one realizes that each pantock is a feet a taken while and 15 feet of inches high Term will be 15 of these—three to each turbine—and they will have a capacity of 62,000 cales feet of water per will have a capacity of 62,000 cales feet of water per will have a capacity of 62,000 cales feet of water per

Four of the 18 turbines will have a concreting on

Smooth and beautiful work on the main spillway section, showing the special piers that will carry the illuminated boulevard along the top of the Wilson Dam

pacity of 90000 horsepower each. The other 14 will develop 86,000 horsepower each. The total maximum installation will be for 98,000 horsepower. And this energy harnessed from the fiver's flow and pressure will be supplemented by the 100000 horsepower steam plant built by the Government that stands on the banks of the triwe a mile pictow the dam.

banks of the river a mise below the dam.

A fine problem in engineering and construction is presented in cementing \$\frac{1}{2}\text{sp}\$ powerhouse forever into the limestone binfus by means of a great core wall 1900 feet long. This core wall will be as high as the dam itself seven feet thick at the base and will taper to five feet at the top This immense, invisible water barrier, deep down in the rock under the earth will for all time pre-vent any possible seepage around the power house end

of the dam.

Perfore Wilton Dam is finished almost 3,000,000 yardisof earth and stone will layer been encawteed from bushs and river bed and 1,000,000 yards of earth and stone will layer been encawteed from bushs of the property of the control of

cofferdam is completed on schedule, entirely diverting the south channel during low water, then the dams in fundations can here be blasted out and econcrete pour ing will relies this section of the structure to smilledem height for work to centinue out it steadily through the high water period of next winter.

A heartile bridge greatment has been at the anomaly

high water period of noxt winker. An harcest bridge spanning the locks at the north ead, a harcest bridge spanning the locks at the north ead. A harcest bridge spanning the late state state state restriction and by the power house. These bridges will have a buckward surface and will carry double tracks for electric cars. The botherard will be a link in three sections of the section of the late of the section of the late of

Here and there the removal of the wood for netes in tare in Penneval or the wood rorms ma-cates the striking beauty and perfect uniformity of the work When finished, Wilson Dam will be one of the most beautiful structures in America Owing to the depth of the power pool, the waters flowing over the creat will be clear A magnificent system of lighting will be installed and the boulevard will be swept with will be installed and the bollward will be swept with evenly distributed rays from reflectors sunken along the parapet. In the river below the dam especially built searchlights will be anchored. These financial illumination will flood with brilliance the about waters flowing over creek and

nowing over cress and apron and the volume of tumultuous tall wa-ters foaming out from the turbines. The idea back of this spectacular illumination is that the dam, being a link in three highways across three highways across the United States will be visited annually by thousands of tourists and should be a creation of shining beauty as well as a generator of

vast power
In the coming great'
effort to make our swift
er inland waters avi gable Wilson Dam most significant beginning to catch a glimpse of the tremen dous significance of nav igation on mountain streams. Low-banked,

show moving rivers like the lower reaches of the Ohio and Mississippi do not carry beats and barges up Ohle and Ministerpy do not the province and the control of the con

Apart by Itself Willem Dam is not a potwe-and-saygation unit. It is only the most imperiant share in the first comprehensite system of river impresenta-tional particles of the North American continuer. This expelled includes places for building power and maying— described the places for building power and maying— —throughout this middle distance between literate liberals (of Respective, Buyeries) of the larger triplestries chysicaly are under devisionated by means of very field distances power-ment suggested in the place of the place of the lateral power-place in the place of the place of the lateral power-place of the place of the place of the place industrial power-place.

divelopment itself will run into hun-dreds of millions of dollars. But whatever financing the Government does on this will be returned to the overnment by the companies and orporations that lease and use the power. These staggering expenditures will not come out of the pockets of the people. They will be far more than returned. They will be muit plied by the vast wealth they smoit from the minerals by hydro-power through the electric furnace. And these dams will literally make naviers. These staggering expendi-

these dams will literally make navi-gation a perpetual by-product of hydro-power. The significance of this is almost beyond present-day vision. The lower stretches of the devel-opment in the Tennessee Basin are fully under way Between the foot of Muscle Shoels and Chattanooga these will be 11 second-teams with or succes and contracted dams, with there will be 11 concrete dams, with locks—three of them power dams. The largest of these, Wilson Dam, is more than half finished. Fifteen miles above—at the termination of the power-and-navigation pool — will be another power generator which will be 40 feet high. Its pool will be 60

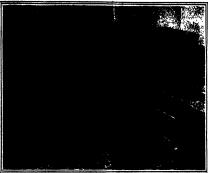
The next five dams will be for navigation alone and will range in navigation alone and will range in height from eight to eleven feet Work is in progress on one of these and the survey for another has been made. Then, 83 miles below Chatta nooga, is the Hale's Bar power dam that has been in

ration for several years, a the manufacturing field Wilson Dam is highly difficunt because it is in the midst of one of the richt and most diversified mineral regions in the world. est and most diversined mineral regions in the work-Fifty miles directly north are the second largest phos-phate rock deposits in America. Within less than 100 miles south are the Warrior coal fields—the most ex-tensive and productive in the entire South. Both north tensive and productive in the entire South Both north and south and sortheast up the river are brown hema-tics own beyond present computation. There is virtually through the electric formacs. And, incidentally, the greatest system of electric furnaces in the world in ready for operation in the huge sir-infrares plant just below Wilson Dam, a description of whose processes appeared in the May tensor of this Journal.

appeared in the May issue of this journal.
The variation between the primary and secondary
power of Wilson Dam cannot now be determined. It
depends upon whether or not storage dams are built to
depends upon whether or not storage dams are built to power of Wilson Dam cannot now be determined. It depends upon whether or not storage dama are built to conserve the flood waters of wither for power uses deriving the summer. It is stated that if the Government immense storage badins on two iribitations of the Tonasseev-che Clinch and Powell rivers. These streams, the contours indicate, can be converted into storage basins by the building on them of very high, but quite narrow.

every and the law of t

World Metric Standardination
IF we are to believe the very logical
arguments of the World Metric
Standardination Council as expressed
the arthrey evoluminous work entitled
"World Metric Standardination," to a rat Forld Motric Standardination, we we wisten no good reason at all twin we will be no good reason at all twin in a standard for the people of the size fixthe father and Great Britain, excit that despected quality of human or the size of the size of



The first of fifty-four penstocks—three to each of the eighteen turbin buge turbine seats is shown in wood forms at the right One of the

put our backs up and resist changes until they are forced upon us. This book contains over five hundred pages of reasons, both argumentative and testimonial, favoring the adoption of this system, but it would not seem necessary to read beyond the opening chapter in order to become convinced that the arguments are rational, and that the metric system is a sound one and would be a most desirable thing—a generation or two after it had been adopted.

two after it had been adopted.
What remains to be done is not so much to convince
the average man of its desirability on theoretical
to the converge the second of the desirability of the converge
man of the desirability of the would touch as in our cally nives, we should have a good command of it and its spiritury values. How-ever, the greatest obstacle to overcome is not mental or temperamental, but is hisseent in inminute and tangfible things—the things that go to make up our ordered and mechanically dominated lives today such as parts of motor_cars and the uniform length of a of butter We live in a mechanical age when

everything about us is standardised on a basts, chiefly the duodecimal, that sets the size, weight and volume of things that we use far more often than we realise. It is the transition from the system of mechne tools which are set to produce these things, many of which cannot be set other-wise without rebuilding that bulks large in the mind of the engineering world But these arguments the book under discussion claims to have refuted It states that many American manufacturers are using the n system of measurements today for the production of export articles They production of export articles. They have stated in some cases that the necessary change in standards was effected without announce and that the use of the metric system has so greatly reduced certain costs as to greatly reduced certain costs as to more than pay for itself. But in the last analysis the decision of whether the system should be used will de-pend on the feelings of the individual. and these have not yet been worked around to the point where the average American or Englishman is willing to make the break.

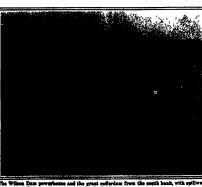
Ro

R O is a language, but there is no Land of ito It is used all over the world, yet the world does not

use it It is a tongue made up out of whole cloth, on a basis of usability
With a knowledge of it the world would become one nation, for language is a barrier that begets many n understandings between peoples who have no way to communicate their ideas in a clear manner, fully and communicate their loss is a crear manner, runy and completely If Ro, or any other of the several machine-made tongues, could be "put over" in a day, if we could all go to bed sujage "Good Night," or "Box Solr," or whatever good night is in Swahili, and wake up saying "Good Morning" in Ro—and go on talking it the rest of our lives just as we formerly apoke our own the rest of our lives just is was ormerly shous our own tongue, this would soon be a better world to live in Or if we could all by some magic be made to talk something like this—"El ye ni clikno up sand fas wriceler al kiwap or temeler ap axed ro", or if when we mike our train we could make sounds like this. "Ut also hopens ut muyab el kibeger odj at tecor fas ov ade

als hopen ut muyab el kibeper odj at teor fas ov ader rugparar in a bleso or keenk, andt a wil ni hab di kleg utbe. In bete or ru²—ir to could the these noble to be the own to the could be the could be the But folse work. They, including ourselves, prefer to "wat kin the ancient ways," as per Osfarcius. The fart is, annaber "Ro" is being built now We speak it: The world is turning more and more to it as a language of the desires and connected prefer to the

Man has been developing a few hundreds of different tongues since a few hundred thousands of years. It line always been a diverging move-ment, the tongues have always dif-ferentiated. But the age of machin err with rapid, easy travel, has mixed the world s people. The age of printing and electricity has already of printing and electricity has already mixed our languages. In a real sense this process has been going on but a contury, yet already there is a strong converging force in the world's speech. It is coming down before long, comparatively speaking, to one tongue. That tongue will hardly be exactly English, or French-or any other Rather will it be a mixture Already there is a vast infiltration of words between the leading European languages, and this process is bound to occur even more extensively in the future A "struggle for existence" is going on between words, and the "fittest will survive" Nobody will have expended any conscious gray matter over it or if they do it will have been as vain a thing as the efforts of certain people to guide the ourse of styles in feminine wear course or signs in relimine went along a rational, predetermined course There will be a "universal language," not so perfect, not so mathematically constructed as Ro. But it will not be Ro



The Wilson Dam powerhouse and the great cofferdam from the south bank, with spillway

Uncle Sam's Agricultural Proving Grounds

The Federal Farms Where Problems of Vital Import to American Agriculture Are Investigated By Ralph Howard

b 175 VII LF Md 14 miles northeast of Woodington is the size of the woodington of the size of the control of the size of the s

ng breeds and classes it can undertake in vestigations which are been do the compass of the average state agricultural c liege and experiment stations while still cooperating with the 48 experiment stations so that its findings may be verified in c ther sections of

the country
The Beltsville Pyperimental larm was The iteratellic Psyerimental Jarm was purchased and established in year ago when the need for agri-cultural previou, ground is all ag calciuml husbandly and 187 screen has a line stock population of 150 animals of 187 screen has a line stock population of 150 animals of the Holstein Ieracy and Guernave breeds and is fully equipped and developed as a modern and progressive milk furu. The animal husbandry farm agregates 508 screen and beast substantial and aerviceable build

200 heres and nones supportantly and serviceshe build ings and improvements
A visit to Bolisville Experimental Farm is as in teresting and instructive as attendance at the bonance state fairs and live stock expositions. Practical in vestigation of vast economic importance

to live stock farmers are constantly in progress at the government farm and usually so much is going on there that a visitor feels as though he had attended visitor reess as rough ne na attended the big, set sk ring circus under the sun Sheep hogs cattle milth goats horses and poultry are bing raised fed and studied in large number. The milth goats of the leading breeds are centralised in a milkin, herd which is maintained under such sanitary and practical conditions in a special stable that milk free of all odor and taint and more palatable and thirst appeasing even than cows milk is pro-

The goats are exnomical producers of milk which is especially well adapted for the feeding of puny infants and invalids I we milking does can be fed and main tained at less cost than the average family

cow and they will produce as much or more milk the neighborhood of large cities there always is op-portunity for the establishment of a practical and profitalle goat dairy

profitate goat carry

Beltaville Farm really is a huge laboratory for the
study of the principles and practices of animal breed
ing The farm has enough pure-bred Bertshire Poland
China Duroc Jerssy Chester White and Tamworth China Duroc Jerssy Chester White and Tamworth sown so that the spring pig crop usually runs well over 200 head Fnough foundation poultry of the leading breeds is maintained so that the annual crop of chickens is around 2000. The flock of Southdown sheep which is handled strictly on a farm basis is without equal in the United States.

The problem of the eastern and southern farmer often is that of keeping his flock of sheep on a limited area. The government specialists have accomplished some extremely menticnworthy results on one 88 acre field at Beltsville Four years ago the stock-carrying ca pacity of this field was limited to 44 ewes and 23 lambs pacity or this neut was similed to we were and on indust At present it supports in contentment and plenty more than 100 ewes and their progray. Other practical problems of breeding feeding and sensible manafidness of the flock are constantly under scrutiny and consid-eration and its activities have been of pronounced profit to sheep railsers the country over

to sheep raisers the country over The positry investigations have demensionable that the utility production of positry can be combined with standard leveling. All the here and crooters have been standard leveling. All the here and crooters have been little are retained for breeding operations which will little are retained for breeding operations which will the same has established a strain of White highester, he majority of the females of which are producing so eags or better during their pulset was: A majority of the individual makes and females in the face's are

good enough in form flexiber and fitness to win in any show which is held in the United States. Meet of the work has been done with White Leghorns and Bhode Jaiand Beds although many specimens of the other leading breeds and clesses are also maintained. These leading breeds and classes are also maintained. These birds have been trapaceted and therefore pedigreed for four full generations. The Fréderal positive experis have also developed a new head of positive which is more robust, larger and healthier and which predomi-as well as the Lephors—or better. These forel have been obtained from judicipes crossing of the Bander Dorting, White Legiours and White Piymouth Rock

breeds
One of the outstanding achievements which has resulted from the swine breeding and feeding investigations at Beitsville has bogs the practical desconstrution
of the adaptability and value of fish meat as a proteinor the adaptability and value of their need as a provider in the result of the Belleville showed that there was practically no difference in the freeding value of flat meal and tankage and that the result of provider the port. This frees the log industry from the limitations imposed by the insufficient supply of packing plant tankage, and is therefore of base impristance to the switnergrowing industry. Further more it least to the efficient unitiation of multious of the Atlantic and Fuedic coasts which heretofore have gone to waste

PROBABLY the most of us who are not interested founder with the number conflications of the natural Department of Agracultur such the teach of the Convenient insertly as a group of bountful and ornamental buildings substited by aspert controls who are familiar with all the complexities of creep production and immediately. Such a appear to assertly of the conflication of creep production and immediately. Such a appear to assertlate all his less from production towas and relationstate to the such as the control of the conflication of the conflication of the conflication of the less state. That is why he members the greatest agracultural growing ground in the whole periferent and part production of conflication of the less state. That is why he members the greatest agracultural growing ground in the whole periferent and grows of immeasurable whole is the so-of-life growers, as possed, that the formation of the conflication of the confl

The animal husbandry experts ascertained that it cot between one and one-hild and five cents more than the continued of the c

Sam was established at Middlebury, YL, for the re-habilitation and development of this spissoft breed. At tits writing, the furn covers 800 series and has a horse population of 75 excellent animals. This farm has resulted in a new base of life for the Morgan

has resulted in a new leave of life for the Morgan horse.

All Brillio, Wyo, is sancher of Uncle Stans horse trans where is well under way the breeding of American to the Standard-Index of the Standard-Index of American to Agricultura- in grings to develop in cooperation of Agricultura- in grings to develop in cooperation with the Wyoming Experience Station. For the cooperation of the Standard-Index of the Station in the Sta

bindiese herame the snow and motivaries would day and freese on their worth and would day and freese on their worth and wide all the states of the states of

*. The order that the dairy separts may be in intimate topid with connected dairy projects. Unde San acts an experience appared for the Gover City, Fra., creamery, an experience appared for the Gover City, Fra. creamery, according to setcled recommended by the powermont, the perchase of trying out under connected conditions, the setcled devised in the laboratory. In addition to the Betteville Dirty Farrage, the Pederal Table profits of the Satteville Dirty Farrage The Satteville Table Ta

returns which the sweet potato and trucking industries alose have realised from the Arlington Farm experi-ments has more than repaid the Government for its establishment and maintenance

From 600 to 700 varieties of apple trees, 300 varieties From 800 to 700 varieties of apple trees, 800 varieties of grapes and 400 varieties of peeches are now being control of the peeches are now being the peeches are now being the peeches are now being the peeches of the peeches are being are besterf from a central plant white a bugst water apply a piped to it in parts of the promote and the publishing are besterf from a central plant white a bugst water apply a piped to it in parts of the promote are the peeches are peeched and the peeches are peeches are peeched and the peeches are peeches are peeches and the peeches are peeches ar

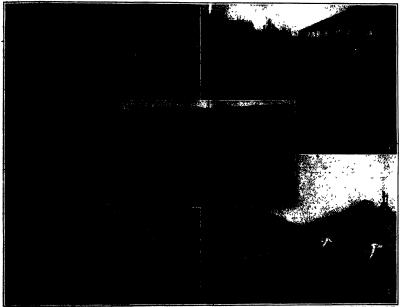
farmer use only specially selected seed of the best varieties, the experiences of a Baryland trucking region

phorus-depicted soils. This is one of the greatest fertilizer discoveries of the modern era as it eliminates the previous transportation problems which were associated with the shipment of phosphorus in the ground

rock form long distances from the mines to the fields.

The investigations of the Bureau of Plant Industry
which led to the definite conclusions that plant growth which led to the definite conclusions that plant growth is dependent almost exclusively on the length of day-light to which it is exposed were also performed at Arlington Farm. These investigations have been pro-claimed by plant pathologists to be the most important discoveries ever made by the Department of Agriculture Uncle Sam s farming scientists are constantly on the

hunt for new cereals, forages and grasses adapted to the solis and climatic conditions in this country. As



1. All the size's units produced at Substrille is used in the indecestory production and tenting of "foreign" channes. I Automortem examination of experimental logs at the Belteville form 3. The Februari form at Artifageto is the largest of the new in the world. 4 The Offs and Pain Laboratory of the Department of Agriculture vehick as present is making a special investigation of extensions. (6. 1). Dub-Laborators Africation, where it studied the effect of litest and dark on paris.

Glimposs from the United States Government's Experimental Farms in Virginia

without goal throughout the entire world as an animal sufficient goal throughout the ment of world as an animal sufficient over a a testing round for crop, ritter, frequency and the sufficient power as a testing round for crop, ritter, frequency and provided as a testing round for crop, ritter, frequency and the sum of the sum o

were trained to the control of the c

a result they are running titule every growing season of hundreds of crops of oversees origin. Through contracting the contrac which are better adapted than those already in use for culture in certain sections of the country. In this way they introduced attaffs to the swetern states, surplumes states. Despite that the general opidion among lay-nons is to the effect that all the valuable farm crops worth working with harve all not been discovered there are thousands of plants of pseudio utility as producers of forage which as 3e the war near been studied.

Our Point of View

An Editorial Grievance

SYCHIC research involves two major questions. The first is do the phenomena of medium-ship occur in good fath, without fraud or tricker; on the part of the medium? The second artee only after an affirmative answer is given to the first, granted that they do so occur, what is their cause and module operand?

is tear cause and source operimate. There is no ground for predicting, a priori, that the average merial would confuse three questions, and be made to discover the one without dregging in the other manners which might be suggested to the second question, any particular one would occupy such a large place in the public mind as to stand for the whole subject matter of up with research. Yet both these things have happened, and herein is our griswance alluded to above. With both the written and the spoken word, we have, after persistent effort, signally failed to impress upon our sudfence.

First, that one can deal with the occurrence of psychic phenomena without at all attacking their cause

Second, that one can deal with their occurrence, and even come to a continuous that they do occur, without giving any consideration to the question of individual survival of death, and without saying anything that in the least degree involves this question.

Third, and more specifically, that our own psychic investigation has not so far had anything to do with spirits, spoots, gheats, or whatever you wish to call these, and that it is entirely possible for us to push it to conclusion without its over coming to have anything to do with spirits, with spiritism, or with the hypothesis of spirit survival and communication

As an alternative to the belief (int. the word it is in an incredibly illipoical most, we have examined our own uterances on these points. They seem quite unambiguous—elect enungle, beyond all doublt, to dispose of the thought that the rest of the world is name, while we are unable to nut a simple thought in intelligible words. New with merjitable exceptions, the world goes words. New with merjitable exceptions, the might be an and whole-bearedly that our finding will increasarity be an endorrement or a repudiation of the spirits, that it is the spirits and nothing elect that we are investi-

The side all We believe we have made it and facility clear that the invation of Zunrpan psychic centers by one of our staff has no direct connection with our formal investigation here. This member of our staff has, we believe, made it singularly clear that, while it is quite impossible for him to attend seances of such varied character and so rich in incident without bringing sway some very definite impressions as to the probabilities of the fraudulent production of what has sees, these events in operations of the probabilities and nothing more 'Xe' he has been widely mister proposed to the see within his orders his Committee's many contributions of the staff of the phenomena.

Again we have repeatedly polisted out that a fairminded investigator may form to perjudgment, and have repeatedly set down the necessity for not leaning toward or against the phenomena. And the world goes right on honoring the enchalf of this warning in the observance and the other helf in the breach-madeling that the investigator must not admit in advance that maybe the phenomena occur, but granting bin the privilege of insisting as rehemently as he pleases that they cannot and do not occur. Were it goes right on assuming that this is what we mean, and cartigating us when we depart from this grandard

Of course the reason for all this is that in the psychic field as in no other, most of us have our own violent preconceived ophicias. Any statement read or heard offers two alternatives—to twist it into disagreement such these ophician, or to twist it into disagreement and reject it. We should be vestry pleased if the world if would overcome its tendancy to perhadan the subsect it valing this, we should be almost as well pleased. If wereylody would believe that, on this subject as on others, we speak after due thought for the firm of our utterance, and mean exactly what we say. Much misunderstanding would be avided if this could be done, must for our attitude, even if we could be sure that all such come to our quitemtion.

Making Airplane Travel Safe

HR DISASTER on the Paris-London Airplan Service, when a machine burst into flames and fell, carrying six people to their death at Monsures, France, was a tragedy which is certain to emphasize in the minds of the public the danger of nirplane travel. Nevertheless, we should guard against giving an exaggerated importance to this event by hearing in mind the many millions of miles that have been flown without any fatalities. We must keep our sense of proportion and consider the wenderful record of our aerial postal service and the fact that commercial service has to its credit the fact that one American company in 1922 made over 2000 flights and curried over 9000 passengers without an eldent, and that the British service had a recor for the same year of 630,000 miles flown without a fatal accident Also, it will help us to a true judgment of the safety of airplane travel, if we bear in mind that, even today, it is a comparatively new art and that some of its major problems have yet to be solved. They will be solved and travel by air will become as safe as travel by train or ship. Statistics of travel show that the railroad train is so secure that a pass ger runs less risk of accident than he does on the streets of any great city. Yet, we must not forget that the toll of injury and death in the days of early ratiroad development was both large and continuo Rails would break, the track would spread, broken wheels and broken axles were common, bridges collapsed, and the frequent collisions took a frightful

Again, just at the time when the stemmship companies were publishing perfectly correct statistics to show that the risk of travel by sea to the individual passenger had been reduced almost to seen, there came, like a bott out of the blue, news of the sinking of the world's latest and largest stemmship with the loss of some 100 lives. Yet, large as was the death toil, when the light of the large that the large state of the state to the individual was raised but were stifethy.

But after all is said and done, it cannot be deathed that the problem before the builder is to make the airplane so safe that the passenger will take his seat in a commercial machine with something of that same confidence with which he starts upon a trip by rail or streambilly. The growing tendency to use all metal construction sugars well for safe travel in the future, and the starts are sufficiently in the starts and the starts and the starts and the start in the starts and the start in the future and in a territorial canger, but it becomes greatly intended if the fire takes hold of the combinatible material of a wood and fabric machine. Hence we look for all-metal to be recognized as the size was not occurred; all subply construction. The possibility of a becine current type of capite; but constituting surely can be done current type of capite; but constituting surely can be done tank; and it should be possible to mount the gas tank to that by the pull of a level to could be dropped clear

The Flurry Over Naval Gun Elevation

HORE who read the article by our naval correspondent in London, giving the facts as to the elevation of British guns, will realize how purely artifield and theroughly mischeding was the recent exceleration on this subject in our daily press. It was included a verificile "suspect in a resport." Mr Dywester traces the development of the mounting of naval guns from the days of Nelson to those of the great war, and we learn that, with the exception of the "Hood," the maximum elevation of the guns on the existing battleships was determined before 1014, and that on not a single ship has it been chansed since then.

The interest in the subject of extress range is due the introduction of sirplines geneting. Before \$10.4, tan to twelve thousand yards was considered to be the extresse ranges at which engagements would take place. Spotting, or observing the full of the shock, was done from the first-centrel platform at the top of the mass, and beyond these ranges it because increasingly difficult to sport with serviceable accuracy. Home the deviation of the string ships are supported by the string ships and the ship of the string ships are ship of the string ships are ship of the string ships and the ship of the string ships are ship of the string ship.

Personally we do not believe that in actual battle a judicious Admiral will wish to fire away much of his limited amount of ammunition at runger, where, even with the assistance of airplane spotting, the chance of landing on the enacy will be small, and surely out of proportion to the amount of ammunition expended.

Let us consider the routine of airplane spotting, say at a range of 80,000 yards, and see what interval time there is between the fall of one salve and that of the next, as corrected by the spotter. After seeing the splash, a second or two is consumed by the aviator in determining its position in reference to the target; it takes additional seconds to wireless this "spot" to the ship; a few more seconds to receive the mes in the central station, the corrections must be applied the change in elevation in guns determined, and this change applied to the sights, before another salve is let go. Let us suppose that sixty seconds are consum in all these operations. A salvo at 80,000 yards range will take about sixty two seconds to reach the target, so that between the time when the enemy ship perceives the fall of one salvo and notes the arrival of the next and corrected salvo, there will be an interval of two minutes and possibly more. If he changes his course as minutes and possets invest it he creating as no course as much as four points, or 45 degrees, as the German battleships did frequently in the battle of Jutland, and if his speed is 20 knots, he will have moved his ships some 2800 feet to the right or left of his course before the arrival of the corrected salvo, calculated upon the mption that he will maintain his original course.

Upon these considerations we have our build that the distance at which actions can be fought will be described by the speed of the slowest ship and the raise of the lightness grean, and not by the naximum range of individual ships. Bestly had a maximum range of individual ships. Bestly had a maximum range above hy over table, of nearly 24,000 yards, although he had the speed-gage of the ensury, be prived to spee the fight at 18,000 to 18,000 yards.

A Notable Venture in Education

UDERFRIADA atomica is being drawn to a proper in the control of th

Fundamentally, the experiment that has been carried on int Anthels College for the past two years in the

Our Point of View

sists and most ambitious of these schemes of education which combine with the college course cortain amount of practical outside work in the field, the factory, or he office. But it differs from all in predecessors in he fact that whereas, hitherto, the outside work has ones regarded as accessory or supplemental to the class-com, in the Antiche system it is given a position of real importance, and the time of the student is divided quality between the two. Thus, study at the college and work in Actiony or office the place in five-week periods; each job being held by a pair of student, who classificates the tweether the study and the shop in Reveweck interacts between the study and the shop in Reveweck

intuition for four and the form of the four and intuition of the continuent of all and include the devolupment of all satisfications which make for a well-counted precasality. In librari, column, and a nateral knowledge of the conditions in industrial, commercial, or professional work as the four the conditions in industrial, commercial, or professional work as the first procession of the conditions of th

We are all familiar with the age-long controversy as to the respective values—the values expressed in efficiency—of the "college-bred" and the "self-made" man acticed aims to seed its graduates out into the world, squipped with the culture and mental training of the one and the practical knowledge of men and methods of the other Obviously, to secure this dual training requires a longer college course than the usual four years, and the course at Antiboch calls for forty five mests of study and work during each of six successive

An incidental but Important advantage is the fact, that the students become practically self-support, the usually haphanard process of "swriting one's sugarbrough colleges" being changed into a systematic part of education. The suore important object, however, is the development, through self-supposed disciplination in real situations, of those qualities which are conspicuous in the "self-sundo man, qualities such as equations in the "self-sundo man, qualities such as equation, latitatives, the sense of responsibility, and the ability to measure one's powers.

And so it comes that the student has six yearly opportunities to determine, by actual experience, the calling for which he is best fitted

It is secreely possible to overstress the importance of that hour when a young college graduate, stunding on the threshold of life, has to choose a curver. The him the shell is all untried, and, except in the case of specialized schools and colleges, or of those who take special courses, the choice is made on no more rational ground than that of the child's 'I' want to be' an engineer, lawyer or merchant. If the other should happen to be suitable to his character and capabilities well and good. But if not, one of two things will happen to be suitable to his character and reconcretaints will 'stream' around' until he finds the work that this in which are triefly to be inevited the work that this in which are triefly to be inevited the work that this is a suitable to the contract of the work that this is a suitable to the course and the work that this is a suitable to the course of the the work that this is a suitable to the course of the term of the course of the course of the course of the term of the course of the course of the course of the suitable to the course of the cours

The Antioch scheme sims to prevent the occurrence of such tragic failures by launching the graduate upon a carefully-chosen career, cariched with a liberal education, and equipped with several years of practical structures.

Progress in Railroad Electrification

FIR APPLICATION of electric traction to the rethreads of the United Rates is proceeding quite closely sing the lines which were precised fifteen or twenty years ago. At that this two ambitions schemes of rullroad electrification that been been been as the companion of the problems by expert committees, namely, the complete situation of the new Grand Control Station,

New York, and of a some of thirty miles of the New York Central s line between New York and Croton on the Hudson. The other project was the electrification of the New Haven line four track line between New York and New Haven.

The public was quick to ravites the grand scale upon which this electrification of the seam railroads of the country was being commenced, and predictions were freely inside that, within a de-ende or so, steam would give way rentirely to else releting under the seam becomedive would take the pince in instead on macrome As usual, and the electrical engineers of the day made lander to explain that, for many variety corns, the chertification of the railroad system of the country, would be confined to ely terminals, to have submire passenger traffe, and to the mountain disloims of the railroads where the property of the control of the country would be confined to ely terminals, to have submire passenger traffe, and to the mountain disloims of the railroads where the property of the control of the railroads where the grades were beney, and where water power was

The history for the past tifteen years has proved the truth of these predictions for electrification has been applied on a large scale only to city terminals and suburban service and to the heavy grades of mountain divisions. The latest development of this kind is the decision of the Virginia Railroad to electrify 134 miles of their system lying between Rounoke, Va, and Mutlens. W Vs. This stretch includes the mountain division where the line crosses the Alleghen, Mountains, and it includes a heavy grade of about 2 per cent over which the coal must be hauled on its way east to tidewater The Westinghouse Company states that this is the largest single railroad electrification contract which has ever been placed. The great advantage of electric over steam operation on such a stretch of line is shown by the fact that, under existing conditions, three Mallett locomotives are required to haul 5500-ton trains to the eastward, up the 2 per cent grade above mentioned, at a speed of seven miles per hour. The electric locomotives will be able to haul trains of six thousand tons at fourteen miles per hour up the same

Strength of Metals Under High Temperature

THE GIRAT advance which has taken place in the consequent trie of temperature renders the question of temperature renders the question of temperature renders the question of the consequent turns of increasing importance. Furthermore the gas turbels is now seeking admission into the field of refuzy prime movers, and the increasing the properature of the gas will reader still more unpeat the problem of providing metals which can be subjected to high temperature without a prohibitive loss of

We have before us a di gram showing the temperature effect on the tends strength of certain metals, published in the April Issue of the Markae Busineer and Areal tradition, and compiled from data published by the Directorate of Research of the Ale Ministry, which throws valuable light upon this anghort. Thus we learn that there is generally a rapid full in greenth with time of temperature, which is majored. The we learn that there is generally a rapid full in greenth with time of temperature, which is majored from the periodic, which had a treatle strength of 41 time at 100 degrees, while that of the district of the time of the disgrees, while the electric stell test piece full from 28 time at 70 degrees as 1014 (time at 850 degrees).

The hest results were obtained with a fleepercent include steel, containing 0,005 pr. cent of carbon which dropped from a tensile strength of 40 has at 50 degrees to 82 c tens at 210 degrees to 82 c at 380 degrees, and then rose to 90 tens at 570 degrees. Naturally the obsavior of this alloy is variable according to the percentage of nicket emphered. Above five per cent the efficiency of this depth carbon was a state of the efficiency of the declarates, but with as high as 85 per gent lickel a tensile strength of 22 tons per aquara lick was obtained at a temperature between 800 and 1000 degrees Fabrenheit. The highest strength at the highest temperature was 28 tons at 1800.

degrees Palivenheit this with a nickel throuding steel Excellent results were obtained in the Boy all Al-Dorre with the exhaust-gos turbine super-charger for mappying all under pressure to calcuterions at high altitudes. Although the Tungstein set triores were only the control of the Company of the Company of the Com-1200 degrees bahra hiet. Coming now to the gus turble, Holswarth, in describing his gas turbine tests, stated that he used referre steel with a yield point of Toos, and a breaking strain of Ti tons, at a companture of helves 300 and 300 degrees bahrenbelt, the greatest 195, 25 and 25 toos new same lack

We must beware of drawing hasty conclusions from the above results. Before they can be considered reliable, the time element must enter into the tests, for we are told that in the case of alloys there has been noted a tendency for the constituent elements to repeated out under high temperature of continuous duration.

Seventy five Years Ago

IIIE NI PYTER AREALAN second to have given min and ships severily five years ago as it does today, but seem to see the season of the season when the series of the season seems of the sea

Another reference which will interest every na ligator in the following "Licettenna Maury has published some charts of 'Winda & Currenta' He has discovered a region of levier winds along the great circle to South America, shoreby the passage to lite, China and all places south of the equator is short-inned some ion ten to fifteen data." Any navigator who sent the track of his vessel with a record of his winds and currents to Wandardam was supplied with a set of these invasions.

The Const Survey was doing good work seventy five years ago in the collection of specimens from noundings. Mention is made of the fut that Professor Agassia necompanied Capitals Davis on his hydrographical work for the Const Survey, and that he had requed a rich harvest of discovery, relative to the animals which inhalt different depths of the water

The Lillor grows enthusiants over the new "Croton Bridge," now known as the "High Heidge," and asks. "What beidge of old can compare with the great Croton Augustus Heidge for old can compare with the great Croton Bridge and Crot

Some statistics regarding the English railroads are given from which we learn that the total length of all roads was 3000 miles. There was an act of Parliament requiring that cheap trains be run to the extent of one dulty, earry line passengers at not over a penny a mile at a speed of not less than twelve miles. It was further required that carriages be provided with seats and

provided from the weather."

A letter from I. V. De Witt in our issue of June 17, 1848, refers to a copy of lumesille early work on me banks, etc., which he sold to the Patest Office. The term of the early were rejected by reson or their exhibition in the pages. Commenting on this letter the effice writes were registed by reson or their exhibition from the publish a work on the progress of invertigation. No one would believe, mires he had woll to provide our the progress of the term of the term of the term of the term of the work of the progress of invertigation.

Our First Test Seances

The Report of the Sub-Committee and Some Details of the Sittings

By J. Malcolm Burd, Secretary of the Committee of Judges



HEN I was in Berlin in March, I went through the Grunewald psychic laboratory which was described in our issue of July 1922 Herr Gruneour name of augy 1922 reer trum-wald has the finest array of scien-tific apparatus for testing medium ship to be frund anywhere in the world. But after you have seen it all he sighs gently and expresses a

quaint regret that all this equipment has been two years idle Other investigators have mediums and no laboratory he complains he has his laboratory and

For four maths the Schettiek American has been in the same boat. Our paychic investigation has been theoretically under way all this time but no mediums had come forward to be investigated. The period of watchful waiting was finally braken with wean vs h a medium whom we shall designate as Mr X on May 21. We have held this issue from the pre-

The scances were hald in our library The table and desk were put out of the way in the corners leaving ample space in the center of the room By blanketing the door and the two wind we with black muslin we the door and the two while we will be a brand were able to exclude all light and get the same brand of total darkness that has already had my testimonial in connection with informal seances Unbroken rows

of total darkness that has already had my in connection with informal scances. Un of shelves line the two km, sides of the room. The medium agreed that these were not likely to interfere with the psychic forces

dittings were held during the evening number were sed during the evening hours when dwnt wa New York is in highlight dip the cleaning women. Our black hangings and cur mysterious noises emanating from a sealed room struck panic into the souls of those stationed panic into the souls of those stationed on our floor they were with the utmost difficult, prevented from feeling the place. The least they looked for apparently was a first-class murder with a mangled and bloods come.

Permanent sitters were Mr Walker and Mr Lescarbours (four staff with myself Mr Owen of the Pincs Mr Granville Lehmann of the American Telephone and Telegraph Company and a friend of the reigraph Company and a Friend of the medium from back home whom we may call Mr Smith Drs Carrington and Prince of the Committee of Judges sat on Monday Dr Prince and Houdini on Thursday on Tuesday the Committee was represented by Mr Frederick Keating a rewinted by Mr Frederick Keating a cal conjurer Other sitters were visitors This medium does not go into trance he occupies

a chair in the center of the circle and comports himself quite like the other members of the group The scance is opened with the Lord's Prayer after which hymns and familiar songs are sung and conversation carried on quite as in the usual sounce. Mr Smith leads the prayer chooses the songs and the moment for singing them and leads the attack upon them. The medium has an admirable voice and joins freely in the singing

Ihis medium has a wealth of spirit controls—nine we went told We beard from Dr Barnett a physician and chemist who speaks in a deep trumpet voice Bert un Englishman with a shrill falsetto Kokum Hawk Chief Osecola and a fourth Indian, all rather deco-voiced but quite distinguishable from one another deep-voiced but quits distinguishable from one another We Smith a bay boy who whapers to his daddy and thristo di Angelo a singing Italian. The phenomena in inde these trumpet and independent vices move-ments of and tappings upon the trumpet douching of the attrees with the trumpets and with agastrasilized hands psychic lights and psychic movement of and playing on a suttar

and playing on a guitar. To get the medium accustomed to the sittees and vice versa, Monday a revotor was held without test conditions, being quite a doplication of the informal sittings I have held with numerous mediums. The trumpet was appoind by the needlems, and Ret with as until the sittings were over II carried is unificant band at \$10 argue and best on Towelsy the medium without persons warning to the contrast, and the contrast of the contrast o

day s sitting Both frumpots were quite harmines. At Monday's sitting the phenomena were very dispointed. We set for half an hore pubers I was touched pointed, which was the half an hore pubers I was touched to minutes these samed bushes Dr. Barnett announced to minutes these samed bushes Dr. Barnett announced his presence through the irrumpet. Throughout the evening a wait of sound minutes thus came between phenomena and the manifestations themselves were extremely brief All that occurred came with a suddenness well calculated to sixtent the sixtens into

extremely brief All that occurred cames with a sud-denness well calculated to attract the attract manner and momentary limitative or observe clearly and was guas on the control of the control of the control of the The volces were fairly light in the room save per Bobbys Touches cure usually on leases or thighs less often on hands cheer to pool head. Mr Lucez-bours after the touching began slipped tha chair back out of the circle as far as it would go—about four unitimately the touches found him. When one of the stiters made the observation that all had confused to a touch save Dr Prince Bert's volce plack up 'Dr Prince has been touched but han a dmitted it. The Doctor vertiled this explaining that he hadn't artisched any importance to the touch any of his neighbors any importance to the touch any of his neighbors any importance to the touch any of his neighbors and prince the control of the volces until the very end when we were distanted by Dr Barnett with a promise of more generous results for the next night.

maints accidinated "Wedenman Ariended"—Just that I good man more and swede say variation. In shops the half since cases the poolings pringined sidest: in the other half will be removed to the product of the will be supported to the state of the support of the s

this betten had to be cut off y a book at the last moment.

Barly 'n Tweeday a sitting there was a support to the control of t

our buttons were settjued betwee and after the manifestation.

About here it beense clear that the spirite had been an experiment of the considered of the considered when the settlement of the considered with the settlement of the considered with the settlement of the considered with the spirite had been settlement of the balance of Tamoday and throughout the Thursday ettlement if was the consiste of everything that happened. Nothing socials would communicate the settlement of the settlement o

The Deadly Parallel

THE MEDIUM

9 36—Out of chair 15 seconds. 9 37—Out of chair 8 seconds. 9 38—Out of chair 12 seconds

9 40—Out of chair 6 seconds 9 42—Out of chair 9 seconds 9 43—Out of chair 5 seconds 9 45—Out of chair for 6, 9 and 5 seconds, in quick

9 58—Momentarily out of chair 9 55—Out of chair 1 second 10 00—Out of chair 5 seconds. 10 17-Out of chair 18 seconds 10 21-Out of chair 14 seconds

10 32-Momentarily out of chair

THE PHENOMENA

Trumpet voice, Houdini touched

Trample voice, found to content.
Tapping on surface of trumpet.
Bird touched, apparently not with trumpet.
Bird touched on top of head
No phenomena Recovering trumpet?
Trumpet voice

Trumpet voice Tapping on trumpet or other object No phenomena Trumpet voice
Houdini touched

Trumpet moving about throughout interval Trumpet in motion

The medium could reach the trumpet with The medium could reach the trumpet without leaving his chair but with an effort with it in his hand he could touch all the sitters without effort Measure-ments taken with extreme care Friday morning verified all this Much of what occurred on Monday would not all this Much of what occurred on Monday would not have called for his leaving the chair every zow and then we got zonething cappelally the wolcas which of the control of the control of the control of the current with infling exceptions nothing took place at any sitting save whon conversation or nong were active. The notions and this friend were easier to have no describe the phenomena of other medium I had the climate by a vote or a twelf. was below at the climate by a vote or a twelf. Mr. Walker from himself towerhold on the hand, and was able to note that the objects was warm giving the impression of human float. When the contacts were the contract was a superior of the contract of the contract was an extension of the contract of the con

trumper.
On commencement of Mandag's seases, Mr Smith assured himself that it was boynagally understood self-annual himself that it was boynagally understood and proceed the self-annual to Judge from his convenients desire the meson that an annual to Judge from his convenients desire the meson the self-annual to Judge from his convenients desire the sense that an annual to the self-annual to Judge from his convenients desire the self-annual to Judge from his convenients of the self-annual to Judge from his convenients of the self-annual to Judge from his convenient to to Judge from his con



Maliett meantitu freight lecemetive for freight service of the Pennsylvania Ralirosd. Weight, engine and tender, 794,000 pounds. Tractive effort, 135,000 pounds

Three Notable Locometives Which Mark the Trend of Railreading

Three Notable Locomotives Which Mark the Three of Railreading

Will present illustrations of three boronoives, one are represented by the control of Railreading to the control of Railreading of the Which they have been built, and in each experiment of the retain parts of the line of the railread systems for which they have been built, and in each reading power, compatible with the limitations of weight upon track, bridges and other structures of the particular systems econocomd. In in Locomotive devices, the structure of the Railreading power compatible with the limitation, Neb. by the Union Facilité Systems. This incomptive devices and the structure of the Railreading Systems and the Railreading Systems. The incomptive devices the Railreading Systems of the Railreadin

mannaning the required steam pressure, Fring na-citities are provided by the application of a mechanical stoker, and a power reverse gear, operated by con pressed air, is used. The tender of the cylindrical type has a capacity of 12,000 gallons of water and 20 tons of coal, and is mounted on air wheel trucks. The Schmidt superheater is employed. The principal data

Length over couplers	90' 6%" 29" dia. x 28" stroi
Diameter of drivers	,78"
Weight on drivers . Total weight of engine and tender	230,200 lbs. 582,000 lbs.
Iractive nower .	54.838 lbs.

also a considerable mileuge of 114 per cent ruling grade earthound out of Ogden In designing a single, power-ful locumentive to obviate the necessity for using double headers, it was decided to build it for fast running on neather, it was section to paid it not near training on level or down grade sections of the lim, and cupable of fairly high speed on long stretches of 0.82 per cent grades when hauling heavy trains. In service, one of these locomotives can hant 816 tons at a speed of 89 miles an hour on a grate of 0.82 per cent, the locomo-miles an hour on a grate of 0.82 per cent, the locomotive developing an indicated horsepower of 3500, which gives the rate of 98.57 pounds per cylinder horsepower as noted above. At a speed of 70 to 75 miles per hour,



etrie locomotiva, mountain division, Pennsylvania ilroad. Weight, 240 tons. Tractive effort, 87,290

the careful counter-biancing was shown in the smooth-riding qualifies even at that high speed.
The imposing Mailett freight lecomotive, which we full restricted the consideration of the consideratio it, this engine will evaporate more water and deliver more horsepower than any locomotive of which they have knowledge We think that the claim is fairly

The locomotive is carried by eight pairs of driving theels, and two wheel trucks under the front frame

The driving wheels are grouped in two sets of four pairs each, and they are 62 inches in diameter. The total load on these drivers is 540,000 pounds, and the total weight of the hocomotive is 575,000 pounds. Adding the weight of the tender, we get a total weight of 704,000 pounds. The maximum tractive effort is 135,000 pounds. The boller is of the Belpaire type, and the barrel has an average diameter of 103 inches. The fire-box is 168 inches in length by 96 inches in width,

and the total evaporating surface is 6656 square feet The locomotive is driven by two sets of simple cylinders of 30½ inches diameter and 82-inch stroke, thus, departing from the usual practice in Mallett compound departing from the usual practice in Mallett compound incomotive design, but a power roughly equivalent to that of compound becomotives is obtained by the use of a 50 per cent maximum cutoff, with a valve of maintaining the compound of th them. formin, a law opening camerical by a 6-field pla. This device, operating in connection with postular central sprince, and theoughly behreisted silling sor-tion of the control of the control of the central control of the central central central central central ing around curves of 400 feet radius. It should be stated that the locomotive is fired by a duples stoker, and that the grades are operated by a Franklin steam grate shaker. The tender has a capacity of 14 tons grate snaker the tener has a capacity of in tons of coal and 12,000 gallons of water We present also an illustration of an electric loco-

motive, designed and built at the Altoona shops of the Pennsylvania Railroad This locamotive was built for remay ivanta Italiroid. This locumotive was built for test purposes, in connection with the decision of the company to electrify that portion of its mountain line traversing the summit of the Alleghray Mountains. The locemotive is now being experimentally tested on that part of the line which has already been electrified between Philadelphia and Paoli. The principal char-scetrifies of this locumotive ur. The principal char-scetrifies of this locumotive ure as follows.

Overall length			76' (34."
Total wheelbase			63'	li*
Diameter of driving wheels			72"	
Diameter of 1003 wheels			36"	
Weight on drivers			196 (ons
Number of driving axles			6	
Total weight of locomotive			240 (ons
Tractive effort			87.20	10 pound
	Overall length Total wheelbase Diameter of driving wheels Diameter of puny wheels Weight on drivers Number of driving axies Total weight of boomotive	Overall length Total wheelbase Diameter of driving wheels Diameter of pony wheels Weight on drivers Number of driving axies Total weight of locomotive	Overall length Total wheelbase Diameter of driving wheels Diameter of pony wheels Weight on drivers Number of driving axies Total weight of locomotive	Total wheelbase GP : Diameter of driving wheels 72." Diameter of pony wheels 36" Weight on drivers 196 Weight of driving axies 6 Total weight of locumotive 240



more to a 20,000-100, 20-2000 coefs liner, whose uppermost deck consisted of a plat form 100 feet in width, and over 550 feet in length, which was absolutely free from any obstruction in the way of musts, smoke stacks, boats or other tion in the way of masts, smoke stacks, boats or other marine impediments A promenade, such as that, would be welcomed by those voyagers who like to continue at san the excretes and out-door recreations to which they are accustomed ashore, to say nothing of those who delight to early a sum-buth, while the ocean winds have free play upon them. Now the remarkable ship, shown in our opening-page

drawing, provides just such a promenade. It is able to do this, because it has been designed jointly as an occan liner and an airplane-carrier. That the plan is a to do this, because it has been designed obstity as an occum lines and an ariphane-currie. That the plan is a coven lines will do an ariphane-currie. That the plan is a designers are Bir Rossace D'Epracourt and John R Anrieth, the former being the chief constructor of the littlish Navy, who is responsible for the latest ships of Development of the little obstitution of Naval Arabitects, will serve, in constitution of Naval Arabitects, will serve, in constitution of the little obstitution of Naval Arabitects, will serve, in constitution of the little obstitution of Naval Arabitects, will serve, in constitution of the little obstitution of Naval Arabitects, will serve, in constitution of the little obstitution of Naval Arabitects, will serve, in constitution of the little obstitution of the little obstitution of Naval Arabitects, will serve, in constitution of the little obstitution obstitution of the little obstitution of the little obstitution obstit obstitution obstitution obstitution obstitution obstitution obs

meetion with the following digest of the paper, to make clear the purpose and main features of this remarkable design. The experience gained by the naval aircraft-carriers, has proved that flying on to and off from ships at sea is rapidly becoming thoroughly practicable, "some 600 successful flights on to 'H. M Argus' and Eagle' have already been made, under varying condi tions of weather at sea

tions or weather at sea."

The paper goes on to suggest, that we are now advancing to a position where the aircraft-carrier will become relatively quite an important ship for the Mercantile Marine, and that ship-owners, when that ans will be prepared to adopt a new type of vessel

happens will be prepared to adopt a new type or vesses of this class for commercial purposes.

So far back as the air conference of 1920, it was suggested, that it might be practicable to carry air-craft on mail steamers, and the subject was also ap-proached from the standpoint of a supplementary naval

intensity in light causes a corresponding reflex action

UTHORITIES call attention to the fact that many per-sons are color-blind, perceiv ing colors only in the form of varying de-grees of brightness. Some have been led to believe that the same thing is true in many cases in the animal world. This variation of the

in the pupil of the eye

It has also been found that apes see color practically It has also been found that ages see color precicially in the same number as human beings, done, cuts and me are manner as human beings, done, cuts and with gray, doves and domestic fowis are red, yellow, and green, just as we convertee do, but are comparatively blind to blan. The experiments with the pupil bacope were confirmed by others such as the visibility or invisibility or invisibility or invisibility or invisibility or fixed of different colors. Among invertebrate animals it was found that only the octopus vertebrate animals it was found that only the octopus prosesses apply which reacts to light, and one author-processes and the processes of the correspondence of behavior between the pupil of this creature and that of color-blind persons. The internesses and fishes because of their possession of compound eyes, s, both basects and crube have eyes of an essentially different structures which usually do not possess a fixed processes as the processes of the processes are crubed to the processes of the processes are considered to the processes and the processes are considered to the processes are crubed to the processes are considered to the processes are processes as the processes are processes are processes as the processes are processes are processes as the processes are processes are processes as the processes are processes as the processes are processes are processes are processes as the processes are proc unerent structure which usually do not possess a pupil. In such cases other experiments are employed. The experimenter found that many crabs, caterpillars and fish constantly seek the brightest portion of their containers and show themselves sensitive to the faintest continuers and show themselves seasitive to the families degree of light perceptible to an ordinary eye. On the other hand, some of the invertebrates seek the darkest part of their continuers, while many ship worms retreat with lightning like speed at the least decrease of light, such as that occasioned by a passing shadow Experiments with about a bundred different kinds of

Experiments with about a hundred different table of Experiments with about a hundred different table of the extension of the control of the extension of the control of the extension of a color sense in fishes, and investigation of the extension of the color sense in fishes, and investigation of the experiment of the

SOW would Ocean Travel by Combined Steamship 2000 would be combined as the street of t

lights, also several devrices for the hoisting of carpo, asteroff, stores, etc. Machines rises expligit from the asteroff, attores, etc. Machines rises expligit from the presence of this forward must would not be objection able to airmos. The deck below is more or less one to permit some flow of all along the underselo of the asteroid of the control of the control of the star above the flight deck. At the forward and of the deck is the navigation bridge with officered quarters aftern of these is a block of twelve lift-booten, a

land or San Francisco, to Hongkeng or Australia, could in the same way deal with Pacific islands and ports intermediate between those points.

Are Most Animals Color Blind?

These new ideas are highly significant, of course, with respect to Darwin's theory of the effect exarted by bright colors in plants and animals, sepecially his theory of the part played in sexual selection, as when we speak of the nuprilal garments of certain fishes and birds as means of attraction for the opposite sex Mr. only when three preliminary conditions are fulfilled, saying. "In the first place the mixture of rays coming from the colored organism must have the same composition as that in which they strike our own retina. Second the nervous apparatus of the animal's eye must be similar to that of the middle portion of the retina be similar to that of the middle portion of the retina of a normal person, since this is the only part which is smallitle to color. Thirdly, we must assume the animal to pussess a certain amount of aerthetic sense enabling it to exhibit a preference for one color rather than

Mr von Hess also called special attention in the case of fishes to the difference in color produced by the doptin of the water, saying: "Water is sever entirely doptin of the water, saying: "Water is sever entirely case of the water in the Mr von Hess also called special attention in the case

and parestre the red classe which the final moves upon certain creatures I riving more than a thorough other certain creatures I riving more than a thorough at this depth not the histories ray of light is visible; in sech depth not the histories ray of light is visible; in sech control of the red control of the red

Color-blindness is congenital and incur-able, and it is due to an unknown con-dition of the retins or nerve centers, or and must be distinguished from transient colorblindness. Fortunately, in the human it is quite abas appears to be the case with animals.

Reclamation of Used Lubricating Oils

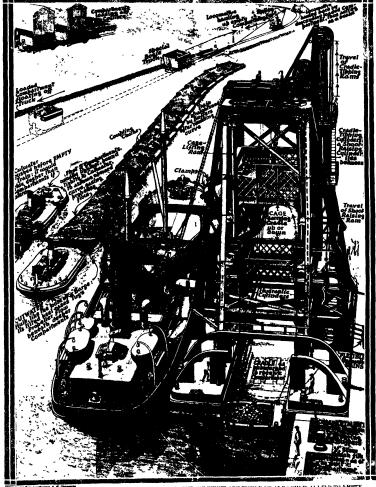
A LARGE amount of labricating oil for automobiles

A LARGE amount of labricating oil for automobiles
that it is not fit for further use, when the only trouble
with it is that it is contaminated with dirt or diluted with gasoline.

with gasoline. For some time past, the Bureau of Standards has been investigating this problem and has found that by using a simple apparatus now commercially available it is possible to reclaim used crankcase oil readering

It is possible to recently used crusticase oil reasoning it in practically every respect as good as new This work is described in Technologic Paper No. 223 of the Bureau of Standards which may be ob-tained from the Superintesdent of Documents, Govern-ment Printing Office, Washington, D. C., at 5 cents per

Acrobantic Rosts for the Handling of Casal Tarther Scheme below the Bartling of Toward II to Green Edition, Mr. W. H. Frunch concribed II to Green Edition, Mr. W. H. Frunch concribed Deler Navigation Canal—s waterway which dates back to 1666—for the transport of cost from the Yorkshire 1666—for the transport of cost of two the Yorkshire 1666—for the transport of cost of two the Yorkshire 1666—for the transport of cost of two the Yorkshire 1666—for the transport of cost of two the Yorkshire 1666—for the III the Tarther 1666—for the III t Acrobatic Boats for the Handling of Coal



A TRAIN OF BOATS WITH COUPLINGS AND BUFFFRS, THE UNITS OF WHICH ARE PICKED UP AND SOMERS AT ITED TO EMPTY
THEIR CONTENTS.—(See facing page for description.)



Counterweighted lift lock for a lift of 129 feet, as proposed for the Rhme Danube Canal, showing the plateau of the Alb which has to be crossed for a distance of fourteen miles at an elevation of 1830 feet

When the Canal Barge Takes the Elevator when the Canal parge lakes the howator Till lift it ick is one in which a huge task expable of the usual statinary look of manony. He typo is especially useful in locati as where as in the German lock here sh was a steep bluff or cliff calls for a single

lock here at wa a steep bluff or cilff calls for a single lift of great helps tank and life contents are conner-lar this design the tank and life contents are conner-lar this design the content are supporting structure. Both: ends of the truth and of the content reaches are cleared by double walled gates which pro-vide security in case of damage to other inner or outer walls. The gates are raised by electrically operated whiches with are soo interictual with the main wind larg gear that the trough cannot be moved while the gates are open and at there the trough nor the reaches can be pened unless the truth is in an end position and properly aligned with them

and properly aligned with them.
The weight of the treath and centents is balanced by a series of counterweights arranged in group and properties of counterweights arranged in group and properties of the propert inertia and friction

We are indebted to Demag of Dulsburg and three associated German firms the kint designers of the keks for ite illustrations who cuphusize the fact that locks for it illustrations who combinates the flut that adulation feature of the designs in the handling of adulation, the feature of the designs in the handling of over a large number of c my aratively small carrying elements. In this way details are kept within limits that hat, already been provided and allocation of the state of the state

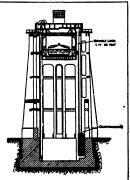
Tests of Welded Tanks

Tilli investigation of the strength of about 50 tanks a some f which had been welded by gas and some by electricity has been completed. This work which was carried out in cooperation with the American was cerried out in cooperation with the American Bureau of Welding was begin on December 4 and completed on Lebruary 0 and gives reliable information on the strength of welded tanks for the consideration of the Pressure Vessal C munities of the Bosher Code C unnittee of the American Rotely of Mechanical En

The results showed that double-V longitudinal welded seams are much atrusper and more reliable than single-V welds. Recommendations were also made cov-ered the design and construction of the heads. The pressures at which these table falled were so high that confidence in the safety of welded tanks, which are properly constructed has been greatly increased. The

method of testing by hammering the weld while the tank is under a pressure of one and one-half times the working pressure, as a discussed Although this test did not prove as effective in showing up defective welds as had been hoped it use is, neverthelves, position as a set of the proper of the

the yield point. These tests show that the tanks are



Front elevation of the counterweighted lift feek, she ing the operating principle

sarie after being tested in this way, As it is probable that tanks having large outlets would be seriously deformed and, therefore rendered sewer/tennels, table quite formed and, therefore rendered sewer/tennels, table quite as not likely to be adopted, that an increase in the tour large tennels and the same and the serious of the depression of Wedding which respirately case of the greatest of Wedding which respirately case of the greatest of Wedding which represents one of the greatest of Wedding which reveals to some Theel time entire which is expirate to some the three portions will be realized when it is constituent that they effect almost every one because of the waste of whether the wedge of the waste of the wedge of the waste of

Sir James Deven

CIR JAMES DIWAR, whose six has recently expenses to be should be a popularly home to be should at the inventor of the thermoe bettle. Bowever, he was not consciously working for what is thus known but rather for something to preserve liquid gases, with which he new novelty put to cause as an effectively, he to he was experienced. The me that he Down tube in new novelty put to cause as an effectively, he has not noted by put to cause as an effectively, he has not to be now the the Down tube his invention, himself for such purposes, but had no invention of commercialities it. He was later able to (legacy byfrough integral to the size of the purposes better than the control to the size integrated byfrough belium and noon from the also included byfrough the measure of corelies. He died at the app of 31 years.

Spontaneous Changes in Balances
THE Furest of Standards has just completed a carFIEE Furest of Standards has just completed a carful comparison of the results of successive tests
curried out on two of its highest grade analyticat bid
noises These balances have been used constantly but
with currence care for some years. Both balances
showed appreciable changes in the ratio of the areas
of wear of the halfe edges. The Bureau considers that
these alterations are the effect of spontaneous changes
in the beam probably caused by the gradual release
of triveness are to guiding the insunstitution of the bal
nance. This study convolutes evidence of such changes
into the study balances of this type and supports the
noted in maky balances of the type and supports the
and similar balances be checked constituting by the
twenty.

Spectrophetaclactrical Sensitivity of Argentite CCENTIFIC Paper No 446 of the Bureau of Stand-David deals with the above subject. It may be obtained from the Superintendent of Documents, Government Frinting Office, Washington D. O., at 5 cents a

many Frenting Office, Washington D C, at 5 cents a copy process of the control of

Our Psychic Investigation in Europe—III

Some Details of a Very Noisy Evening with a Private Psychic Circle in London

By J Malcolm Burd

Associate Editor, Scientific American, and Secretary of the Scientific American Psychic Investigation Committee



OLLOWING a week-end at Crowborough OLLIWING a weak-end at Crowborough with Sir Arthus, came a seame on the swaining of March 5, which in some respects was the most remarkable of my entre trip I shall describe the events of this sitting first reserving comment for

ě

At Mr Bird, B: Sir Arthur Conan Doyle after the re-arrangement C: The progressor of the pressions. D The young lefty who laid hereel to gen to mapicion in connection with the movement of the circular plate in E (or D) Sir Arthur continue. Sir Arthur continue of the structure of the circular plate as the structure of the circular plate as in the centur of the table.

The arrangement of sitters

.

the end. Also, without in any way moulting myself, I shall use the ary experient vocabulary of the

constituting suppost, I shall use the very engineers revokuleary of the survey engineers. Outsideers can, which has both sittings can so week the control of the control

and the turning down of the gas I was able to take stock. Bagular readers of the SCIENTIFIC AMMICAN will recell, some time ago a full page of pictures show-ing the noise-making parapherantia of stage and screen Glancing about the table I could think only of this. will read, some time are a full pass of pictures show, in the holosomethic parameters of the pictures and the pictures and the pictures and the pictures are also as a most amenting array of apparatus acattered about, and clearly we were to have a noisy evening Two the-holos "trumpets", a small and a large bell of about, and clearly we were to have a noisy evening Two the-holos "trumpets", a small and a large bell offer of the pictures and the pictures and the pictures are also of the pictures and the other of the pictures are also of the pictures of the pictures and the pictures are also of the pictures and the pictures are also of production perceived and the pictures are also pictures are also pictures and the pictures are also pictures are also pictures are also pictures and the pictures are also pictures are also pictures are also pictures and pictures are also p

one prolonged riot
Though Iris ran the scance two Thous! Iris ran the same two other identifies took part. John the rapper and Bell, the violently noisy member. It was for the spicial delectation. I Bell that the its drum head had een provided. He used it freely and also dealt the table some freely and also dealt the table some fearful !! ws with stool and mallet lave that the sleighbeils were apt save that the sisignment were apt to go off at any moment and per-haps also with an exception in favor of the rays I do not recall that two pieces of apparatus were at any

pieces of apparatus wer at any time in simultaneous operation No attempt was made to receive messages of significance the gather ing with the spirits was wholly a ang with the spirits was wholly it social one. But the noises were by no means all that happened. Iris wrote on her pad messages for Sir Arthur and myself. One could hear

Arthur and nurself. One could hear the panel in artiching over the panel in artiching over the panel in artiching over the panel to table. The completed message was ton off and thrust into the hand of the addresser. I had no sense of polyselst contact and no there direct impression that the proposed contact and no there direct impression that the proposed of the panel of the pane

tonight Me thought you would like me Iria. The letters were char actariateally a child a script. The lines ran eccentrically two of them actually interfering while the mar-gins at both eddes were highly irreg-ular—all as one might evact if a human were writing in the drik. Iris could see better in it e dark with the trumpet than with the pos-

cil Her best stunt with the pen-cil Her best stunt with the was passing it back and forth are as the table touching Sir Arthur nd my self in rapid alternation and with sert in rapid alternation ind with good accuracy upon our left hands We were directly opposite ne an other, the long way of the table The successive contacts as marked by our exclamations were very close indeed — but the fact til two ets were on the tuble made it out of the question to accept the

out of the question to at opt the demonstration as proving antithing. Iris later gave an exhibition of the province of the pro

it very neatly out of my group. The red screened lamp had a switch for turning it of and on, which was quite said—not really difficult to throw, but requiring a distinct post. While the lamp reacted on the table, fire placed frostly with this switch began to mave the lighted lamp shout the room back and furth and up and down, over the table and the

human voice to maintain comes tousty throughout the seance the shrill tone of Iris wise.

Iris demanded that the light it dispensed with and we sat in total distributes until spin the end I need not describe in secureor or in desarfible notes that set under the describe in secureor or in desarfible notes that set under the describe in secureor or in desarfible notes that set under the lamp was never turned off or on while in the set of the secure of the security of these were mark it most were desirably the product of under the setting. Few of these were mark it most exceptiting were when the most exceptiting were when the most exceptiting were when the stable was based of the production of the proposition of the production of the productio This work on for sow times to the least of any recible into the lamp was never turned off or on while in mitin. It would appear somewhere at rest it would then come to a mount if would term come to a travel about for a mount if would term come to a travel about for a mount if would term come to a many and also agreed to do what she would in this direction. After an interval the abits was held up vertically and also agreed to do what she would in this direction. After an interval the abits was held up vertically and also agreed of its phosphorocount nurtract. The flaggers were too that free a human hand and too small and they were quite ill shaped. First did not think that she could do any better than this but under uring, she went to make marterial contacts with the hunde for "It Arthur and my besttl. Presently "If Arthur felt the tau in "a flance," and upon the back of his hand then it cause if a flance, and upon the back of his hand then it cause if a flance, and upon the back of his hand then it was not always to the same time of the same time of the same time. It seemed to me that this verdist must be the result of auto-suggestion built about the expectation of a child's finger for the finger that touched me impressed me as quitec arm and hard Sir Arthur day got me re of an im quite c arm and nard. Sir Arthur the got in re of an im. I result no firmal field us than I did especially in the case of the finger nail which we both folt quite distinctly. If n thing had been said about I ris intent. I should have dismissed the incident with the mere

I should have dismissed the incident with the measups still a that one of my neighbers had touched me. The phosph rewest laket was carried about the table within the hamily and pre-a fixed to each stirter. The within the many and pre-a fixed to each stirter as the made the tour f the table. That the sixte made the tour f the table. That the sixte made the tour f the table. That the sixte made the tour f the table. That the sixte made the tour f the table. That the sixte made the tour f the table. That the sixte made the tour f the table. That the sixte made the tour f the table made that the many that the table made that the table made the table made that the table made that the table made that the table made that the table made table made that the table made table made

In the center of the tal less circular In the center of the fall least reular plece were 16 inches in diameter has been cleanly out out. This piece had been preserved intact and it sat saughy in the hole from which it had been out like a plus or lid the hearing surface being a bewilled the circumference f beth hole and plus. On this back a hie of about a quarter inch dianeter was bord I il/ nially into the talle top and fr ii the edge of the elr ular panel a | in pr jected fitting into the hole

If one is to remove the circular

| life it must obviously be withown in the direction parallel to the axis of the pin A mere random thrust fr 11 bel w up n the surface of the circular plate will not with any extinity displace the plate against the 1 king action of the pin
To the under side of the table all
ar and the edge f the circular gap had been att ched a bag of heavy fabric Sir Arthur and I examined this finding it quite tight all around its function with the table as well as over its own surface. It was In its bottom reposed a large bell with a loose clapper. The idea was obvious—the hig cum t be greatly



Section it rough its on ter of the table at the point where the apparatus for the final act of the seames was founded. The cir-cular plate is shown in perspec-tive titled up in its sent. The large was featered to the table solar around the hole as indi-cated. The surest amount of the large different part of the large different part of the large different part of the large different holding the bell is not known The setting for the final act of the seance

agitated without causing the hell to ring agitated without causing the hell to ring.
As we sat about the table in full gaslight the circular
plate was repeatedly and violently jerked from its seat
and thrust tilled out of the hole. John was stated to
be doing this I asked. Is that you John' and the
plate responded "Tes with three predigious uph-cavia.
One of the alters was able () put the plate back in its sent only by struggling hard against vigorous opposition. This business continued for five minutes or so, the motion of the plate getting weaker and issure request all the time, when at length it refused to move any more, the sitting broke up.

80 much for the pleanousea produced. The eatire seames, save for the preliminary sleighbells and the final

20

seance, save for the preliminary sleighbells and the final act with the circular plate, was held in complete darkness, no attempt was made to impose test conditions, or even to apply tests. This prevents any serious opin ion's being passed as to the genuineness of the phenomena It must be admitted that some of them were, nomen . It must be admitted that some of them were, intrinsically, far from impressive, and that the whole sitting had a very direct turn toward consely, horse-play and drives suffill but it would not be fair to conselve the sufficient of the sufficient to the sufficient of the sufficient world around us. To justify this admission, we need only point out that to have withheld it a generation only point out that to have withheld it as generation the simple sufficient and the sufficient sufficient with the sufficient sufficient which and if an unidentified force or energy is really at overly, we make a very large and unjustifiable assumption indeed when we demand that it produce results which shall appear dignified, and in a be left behind us when we other the secure room, along with our readulity if we be credules, or our pepsidicas

be left behind us when we enter the senne room, abone with our oredulity if we be crediums, or our pre-judges if we he at all inclined to err in the other direction. So we can well afrord to admit that many of our sennes results are unimpressive on their own grounds, and when they are not to be a superior of the sentence without any loss. More serious is the admission that any four results are such that a single sitter, perhaps with a single mission that any of our results are such that a single sitter, perhaps with a single mission that any four results are such that a single sitter, perhaps with a single sitter, perhaps with a single mission that the sitter of the connection with the relations existing among the sitters. Nobody, so far as I among the sitters. Nobody, so far as I know, pays any money in connection with these sittings—not even the occasional outsider like myself. This was the one seance I had in Europe for which I did not have a charge of a guinea or more to meet. No attempt is made to gain public recognition of the circle and its results— such recognition is actually shunned, and such recognition is actually shunned, and so successfully that many British spiritists will not identify the group from what I have said about it In the absence of any medium, we cannot suppose that fraud is committed to give anybody the sensation of being a big frog in a little puddle— there isn't any big frog in this puddle And if we take the circle to be fraudulent in its entire membership, we must assume that it has been held together for seven years, and brought together once a week throughout that period, for the very in-

termittent satisfaction of imposing upon the mal ontsider

The joining of hands all around the circle is another The joining of hands all around the circle is another consideration. Or course this does not at all prevent fraud, but it enlarges the number of effects who must was observed could have been done by a single hand, we should require two parties to the gullty servet—the owner of the hand, and his neighbor 1f both hands of a single operator were required, we should need three of the sitters in the trand. If the reader will accept of the sitters in the trand. If the reader will accept of the sitters in the fraud. If the reader will accept my impression that the phenomena observed would have called for the active cooperation of at least two of the sitters, at opposite sides of the table, the number of tricksters jumps to siz. For money or us a casual sectioners jumps to six. For money or as a causal indoor sport, one might pleture half the group as vicinizing the other half in this manner, but my imagination failters at the iden of their gathering every week for seven years on this basis.

seven years on his basis.

The rearrangement of the sitters of course was bad.
In a majority of my seances a shift of this sort has been demanded, on the ground that it would "make the psychic currents run better". I think it fait to say this is a very suspicious circumstance, and that in the present instance it becomes doubly so in view of the described rightly of the senting arrangements, is robing

described rigidity of the scening arrangements, invoving no less than forum rembers of the circle. Of the specific phenomena, the sieighbells were the weakest. By no caselvable means could one know or guess where all the fact were when they rang. In the bargain, their action was always accompanied by a fissinct third, and a jar to the table, exactly as though a material foot had delivered in unterial jab upon the

incitior thom: By simpling more manageable than a context it could give a second to the could be a second to the second to the could be a second to the secon

as a grave violation or seance etiquette.
I must insert a testimonial to the planist Through I must insert a certimonial to the planist Through two hours of absolute darkness be played brilliantly, and only thrice was he forced to hestate while he found his place on the keyboard. At times he absu-doned the plane for the violin If the thing were alto-

desect the plane for the violin. If the thing were also sether vanderlik, his centribution was by no mea-sure the setting of the program.

The behavior of the lighted lamp was perhaps the most impressive festing of the senses. It covered far in the hand of a saling sitter, There was no irrequisity in its motion to support the belief that it might have been passed or forsed from hand to hand. It had no wires or other permanent connections upon the end of which it might have been avenue.

Like so many other things in my seances, and I am told in seances in general, the travel of this lamp went on with extreme precision. For instance, it swung from

ame far too close to the respective members of true to permit the assumption that they were hand y any one member from his seat. But here I may

offeries (o permit the assumption that they were handled by any one assumption that they were handled by any one suspender from his man. But here I may be wrote.

I would have been descended a great deal of neityling on the part of the sitters, but heyend this there was entirelisted research with these noises could not have been included by the continuous countries. The continuous countries were the state, the presence of a single phenomenon, would downless be that it was certainly done fraudulently, but when one also for two hours, and finds all sorts of different any direct audities evidences of fraud, one sits of two hours, and finds all sorts of different any direct audities evidences for fraud, one heatington. The climax act with the develop plate has made this group of attent rather finous among the leaders of surprise of the contribution. The climax act with the develop plate has made this propose of the contribution of the light, under conditions making fraud impossible. While it was going on, I had not examined either plate was cutting up, what was going on, I had not examined either plate was cutting up, what was going on, I had not examined either plate was cutting up, what was going on, I had not examined either plate was cutting up, what was going on, I had not examined either plate was cutting up, what we going on, I had not examined either plate was cutting up, what was going on, I had not examined the proposition on the plate was cutting up, what we going on, I had not examined the proposition of the ladder. At the same in the plate was cutting up what settles in the part of one of the ladder, and the control of the ladder was proposition of the ladder of

When I finally examined the layout When I finally examined the layout under the table, it seemed clear that the lady, unaided, could not have produced the results observed. That the bag was really tight I am confident There would remain the possibility of a mechanical connection between plate and table, but the plate offered hear resistance to being resplaced, while so far out of its seat as to replaced, while so far out of its seat as to the season as the season increased in the season in the season in the season in the season of the season of all rene its most when the plate was unsected, so application of if the plate were unsected, so application of if the plate were displaced by direct human against working through the bag, from outside, we should have three possibilities regarding the behavior of the built.

working through the hag, from costelle, we should have three possibilities regarding the behavior of the belt. First, the beg night be shaken so hard that the belt might rise; but it dight ring. Second, in bag night be might the shaken so hard that the best might rise; but it dight ring. Second, the bag night belt with the shaken so have a single shaken and produced without sufficiently raising the both, but this possibility I had in mind while examing the beg, and I concluded that there was not one of the sitter of sugarding the both can be considered to the same of the sitter might have anchored the lower part of the bag with its foot, while nonther operated upon the plate through the upper part. But owns for this part of the bag with its foot, while nonther operated upon the plate through the upper part. But owns for the language of the site of the plate which have called for vary violent kicking of the upper part of the bag, while the lang of the suppletons stitting of the plate which have called for a stage of the suppleton stitting to work and the possibilities I should not care to so, on the basis of a shage character and the plate of plate of the plate when. I would upon a shake the sampling of the sampleton the plate of plate of the plate when, I would upon a shake the sampling of twist. After the softnesses, their occurrence be an of security of personal, We por tail lifts asked wises, by investigating pipelie phenomens, we shall that maybe they do occur. After this softnesses, their occurrence be an or a cessition of generalities or of improbabilities, but one of fact. On anotice page of this issues, he have mode to desire

On another page of this issue. I have made it clear why I feel that the issue of frank vector genuine me-(Continued on gaps 70)

TE have no space to repeat in detail the conditions for our psychic investigation, published in full in the January usue. For the gen-eral convenience, however, we repeat the vital points of this

amouncement
The SCHNIFFC AMERICAN will pay \$2,500 to the first person whe
produces a psychus photograph, under at sets conditions and to the satisfaction of its Committee of Judge.
The SCHNIFFC AMERICAN will pay \$2,500 to the first person who
produces, under its test conditions and to the satisfaction of its Judges, an
objective psychic manifestation of physical character, other than a photograph, and of juck with that personnent instrumental record may be made

of its occurrence. of its occurrence.

The Committee of Judges shall comist of Dr. William McDougall, Dr. Dariel F Comstock, Dr. Walter Franklin France, Dr. Hereward Carrangton, and Housan the conjugare In the series of death or other diability, a temporary or permanent substitute for any Judge may be nomed Entry must be made on or before Decambe 31, 1924, to the Secretary to the Committee, at the SCHENTIFIC AMERICAN office in New York Ether award will be made on unaminous vise of the Judges, or on a four-to-ore drawn. Seencest with any medium shall terminate and all haid claims to the award be reacted upon refection of the mediumship by formal claims to the award be reacted upon refection of the mediumship by formal

vote of the Committee.

All the conditions for entrance, seances, etc., which are laid down in the full announcement of our lanuary usue, are part of this offer.—THE EDITOR.

> a point at the far side of the room, well outside the circle, straight toward me. Had I been leaning forward, it would have struck me squarely, it halted just a few inches short of where my face was at the moment. The incress snort of where my zace was at the moment. The very smallest assumption one can make regarding this sort of thing is that it is done by one of the sitters who, by shormal vision or by other means, is able to locate objects in the dark as accurately and as promptly as the rest of us do in full light. There is no hesitation or exploring, no fumbling, accidental contact is never made with the heads or hands or feet of the never made with the heads or hands or feet of the sitters, and intentional contact is firm and accurate; and there is never the least bit of rustling, shuffing, brething, or other indicates that one of the sitters is in motion. More than any other feature of seances in general as I have observed them, this demands explana-

> In connection with Irie fingers, the variability of obas common incident of seasons and for that matter of court rooms in which two winesses attempt to describe court rooms in which two winessess attempt to describe the same incident. It presents a most inter-wing study in psychology, but its intrinsic importance in coinsi-tion with the incident upon which the disagreement occurs is easily exaggregated. At casts no discretiz upon this incident, one of the observate is right and the other is wreng, or more limity both are partly strong—and that is att.

> Several of the phenomena seemed to require, for their explanation on a basis of Trued, that the chestings nember of the circle actually be upon the table. The tour of the table made by the sistes and the bell was one of these. My best judgment was that these objects



delt. The shet seem, The meles had along is dropped from a size in the top and finit life (in jine water After coulties, it is destinated to be when it is localities and foliates between the same of administration between the work of the transfer could be a made in the same of administration between the work to form or the same of the same of administration between the work to form; which the top-refer counties are not administration of the same of the same

Mathematically Perfect Balls of Lead Called Shot

Called Shot

If the end of an ordinary shotsum shall be uncerimped, or will red iscores of shining shot; besutfully benched, perfectly proded as to six and absolutivity round.

If the yarded are to six and absolutivity round.

Cause to complain of the churge of shot in the shalls be uses. If the individual pellets are out of round, of it they vary in sixs, he will return from the hunt with see genne in his shooting leeds, regardison of how good of shot, fired under test conditions at a prepared integer of shot in the shall show the cause of the disappointment. They show that the shall show the cause of the disappointment They turn will show up the cause of the disappointment They turn will show up the cause of the disappointment They then the short of the shall be sh se because they are not round.

To produce, day after day, year in and year out, shot that are truly alike, true to gage, round, equally bur nished and equally hard because of identical composimanea and equally naru becume of identical composi-tion and identical methods of production has required the perfection of a process, which, far from being merely the dropping of a lot of melted lend from a sieve into cold water, is highly specialized from start to into cold water, is highly specialised from start to finish, throlving the previous inaunfacture for the pur-pose of a whole family of special machines and the training of a special force of mechanics in traditions of care and accuracy The descent of drops of molten lead from a high tower into water, although an ancient method of making shot, is still retained, but only as the heart of a lengthy but modern scientific process. With the retained the ancient shot tower, and it is one of these structures, a landmark on the skyline of New Haven, Conn, which contains all the special machinery

Haves, Coan, which contains all the special machinery that turns lead and antimosy, in varying proportions according to the degree of hardness desired, into 80 most soft hinting peliest every working day. From the time the molien lead pourse from the high caudiorna in the top of the tower until the shot in delivered over the counter in the shell it is not touched by human hand. The whole chain of processes is automatic. Gravity more the product of the contraction of the processes in automatic. Gravity more the product of the contractions and the machine does all of

the work.

As shown in the cross-sectional disgram of the shot tower, there are at
its rep two mailing pots and two
drug tribes. The significance
of this is simply that two
hispin of shot are provided
from, the childed and the loft
or drup shot These varies
the zero mode by an of sainthicky with the hald. Otherwhile the two re made in some with the lead. Other-wise the two are made a conscily the same manner. Therefore in our description we shall omit the lower leading pot and follow Chemian the parameters of

drop shot from the upper of the two cauldrons. The lead is mixed with the antimony in the desired proportions in the turners at the ground level. This is shown at the left of the diagram

m

From here, after being run off in pigs, it is elevated to the melting pots at the top of the tower The temperature of the molten muse is always kept uniform a precaution very neces-sary for the produc-tion of truly round drops of falling metal
The cauldron must
also be stirred constantly in order to stantly in order to keep the molten fluid at uniform viscosity throughout

The molten mixture is run through a sleve of a mesh chosen according to the size of shot desired Falling a perfectly round shape, and as they fall through the air are sufficiently cooled to form a crust strong enough to retain its spherical shape until the shot has been cooled in a tank of water at the bottom of the structure. The descent requires but 81 seconds.

Next the cooled shot are dried by heat and returned

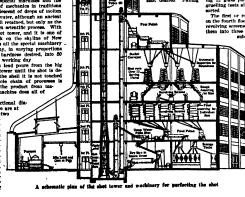
thence through a distance of 154 feet, the drops assu

by a chain and bucket elevator half way to the top of the tower Here are begun the several finishing procof polishing, inspecting for roundness, as emes or poinshing, inspecting for roundness, assorting for size and repollabing. At the sixth front he shot is given a preliminary graphite pollsh by two large rotat-ing drums and then it descends by gravity to the glass sorting trays on the fifth floor. Here it is carried to the ganalter curds of a series of glass, fan shaped plates the smaller ends of a series of giass, tan hisped plates having their whiter ends inclined downward of these plates there are 13 in each tier and they are arranged in superimposed sigzag from As the shot roll along these plates the perfectly round ones run freely down the int lines and the speed thereby gained smalles them to jump a curveful gained gain at the lower edge of the giass. But my judicial gain at the lower edge of the giass. But my judicial shot which he slightly out of round or which is imperfert in any way cannot get up the speed necessary to make the jump and falls by the wayside later to be remelted. The shot which hus passed the first gap must, however, pe has passed the first gap must, however, pass 12 more gaps of a similar nature, corresponding to the remain-ing 12 glass plates. At the end of this series of 18 gruelling tests all the shot is considered to be perfectly sorted

The first or rough sorting for size now takes place The first or rough sorting for size now takes place on the fourth floor. Here the pellets are passed through revolving screens which are performed in order to sort them into three general sizes, the more particular or subdivided sorting of the products of these first screens taking place on the complete of the products of the products of the products of the sort of the products of the same place. The short is now given a

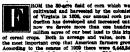
final polish which adds the perfe luster which characterizes good shot, and it is thence conducted to the storage tanks.

Tests for diameter numb avas for camerer number of pellets per conce hardness, round ness and general appearance are now made on the finished product Chilled shot being harder than drop shot, is not mutilated as much when fired from the hore of a shotgun, and therefore gives bet-ter patterns. The makers, know-ing that soft shot has better kill-ing powers than chilled shot due to the upsetting of the shot in the game, have found it necessary to have a standard hardness for each individual size of shot. The poured individual size of shot. The poured shot runs in size from dust to size TT, making a total of 20 sizes. But the nine sizes of buckshot are cast. There are also ten sizes of lead balls which are cast ranging from the 44 caliber to the



Where Corn le Kings

Why Our Agricultural Prosperity Depends Largely on Our Annual Hundred Million Agres of Com By George H. Dany



BOM the 80-are field of corn which was cultivated and harvested by the colonies of Virginia is 1000, our annual covin produced the section has developed and increased until our certain the seven of certain the seven certain two plant American Zameire growf. According to the census of 1000 there was 6,468,468 frams in the United Rates and last year 742, per cent of them rateed as average of 15 acres of cens per farm in the office that twelve years, our even even per have worth more at market them than both our wheat and waiter of our corn cey has been greater than the combined values of all our exitie and swine produced for slaughter.

blased values of all our extite and swine produces nor suggestion.

The pricer families which always are most numerous close to the scarce of maximum corn production caver to content to the American corn crop into mest and lard. Horses consume 20 per cent and cattle seat 15 per cent of what remains. Ten per cent of the crop is converted to merchants. Ten per cent of the crop is converted to merchant four milks. Corn is also used extensively in the form of sliege, fodder and stover as feed for donnels interest. It takes four milks a feed for donnels illustrated. It takes four milks a feed for donnels illustrated. It takes four milks are stored to more delicities of the country. Two and sheep that are fattened for market are typical and sheep that are fattened for market are typical and sheep that are fattened for market for the carteries system in these grain fields. In excess of £000,000 scens are cet for fodder each year.

Six of our States, including Iowa, Illi-

Six of our States, including Iows, Illi-nois, Nebraska, Missouri, Indiana and Ohio produced 48 per cent of our entire corn crop as well as 45 per cent of our corn crup as well as 40 per cent of our pork supply and 25 per cent of the beef which goes to feed our 107,000,000 people. Corn is king not only because it occupies more of the farmer's time and attention more of the farmer's time and attention than other comps, but also because it is the principal source of tood for the American people, either when consumed directly for human nouristiment or converted into world's annual corn crop is produced in the United States. There is no other comprowing region which equals the fanous American corn belt. Agreeting, Braail and Mickello give considerable corn, most of case of Arguntina, where the output is largely experient.

European countries raise one acre of cora to every four that are grown in the cora to every four that are grown in the land where the Stars and Stripes are the national emblem. Among the leading foreign growers of cora are Italy, the Balkens, Hungary, Spain and Portugal. Southern France also grows some corn, while the Rumanian and Hungarian plains, most nearry approximating the American cora bett in soil and climate,

American corn belt in sell and climate, produce considerable corn for home consumption and five export purposes. The people of India and Egypt grow much corn under irrigation and use most of the food locality. During the last three years, the world crop of corn has agreegated about 8,000,000.000 bundels. As the United States is the justime producer, the world output is generated about 8,000,000.000 bundels. As the United States is the justime for short force, the world output is generated about 8,000,000.000 bundels. As the bunder of the producer, the world output is generated about 8,000,000.000 bundels. As the United States is the justime of the food of the producers and the states of the st

in the Virginia and Massedifficatic solonies how to balant, cultivate and harvest corn. Originally, the only tools used were crude how and spades. But soon the conducts harvestooned Raginia power, and freign that time conducts harvestooned Raginia power, and freign that time conducts and the conduct harvest and the landsmoothed that the description of the conduct harvest and the landsmoothed harvest harvest harvest and the landsmoothed harvest harves

By George H. Duby:

Indic of Tunnesses, Kantucky and the Shittiewest fortiery were particle. One was related as the chief freey were particle. One was related as the chief freey and rhat cattle. As notlinguish was extended one production developed. The purpose feet on the relation and control of the contr

BOTH in acreage and in value, corn is the most important of America's crops. In 1920 there were 6,448,-

campaign Climatic capers pre-vent corn from being raised prof-itably in all parts of the

ing season must be at least 150 to 160 days in built.

Bathall must be smilester and will distributed. Barball must be smilester and will distributed. Barball must be smilester and well distributed. Barball must be smilester and will distributed. Barball at a time when it is long insturing. The peasest shift of every core become it job dropped partials that but matter very early, as other antispendents included in the smilester and the smil

decides interest to the control of a versuage over continuous coquilibration and harvest have smallly increased in the United States have similarly increased in the United States have been a similar predecided of our maintain predecided of our maintain predecided of the United States have been any similar produced in the same and the prevents any regarded of self-section of the same and the prevents any regarded of self-section of the same and the prevents any regarded of the same and the

corn creeder of to develop strains that will make very early, as each solitonesses paragraph of the tending corn rating possessions through each tending corn rating possessions through each tending corn rating possessions through each tending corn rating possessions through the corn rating possessions through the corn rating possessions through the corn rating possession to the section of the



rimal conditions; and providing for storage and a commissed either providing for storage and a creation of the feture, and thus exceeded major period in the feture, and thus exceeded (Showing organizes the property of the property of the property of the account of the property of the first and property of the account of the property of the first and property of the property of the property of the property of the first property of the property of the first property of the property

The Fourth Dimension

THERES is a strange delusion that the fourth dimen-is son must be something wholly beyond the conception of the ordinary man, and that only the mathematician of the ordinary man, and that only the mathematicum, eas be initiated into its mysteries. It is true that the mathematician has the advantage of understanding the for advantage of problems which ses be indicated into its supriseries. It is true that the mathematician such such as developed or understanding to scientistic mathematics as the secondary of understanding the scientistic machinery for solving the problems which say parts in studying the world of four discussions, and a superior of the world his point of view is the man discussion of the world his point of view is the man thought the mathematician throws himself into some state of transport which he provide was not hitherto unsuspected transport in the provide was the provider and the provider of th

This news that the events around us form a world of four dimensions is as state as the news that Queen Amas is dead. The reason why the relativist resurrects this ancient trution is because it is only in this entiti-tion of the state of the state of the state of the sacree of all observer need. In our own experience as dimension is sharply separated from the other three and is distinguished as time, but our experience is soilly the results of the state of the state of the state of the prevention, and if we insist to bottling the scheme of nature on purely terrestrial experience we are limiting opposives to the medieval geocentric system of the

words.

We can rove eliminate from the control of t

When we look at any object, any a chair, the impression on our tyes is a two-dimen stonal picture deelean yleture de-pending on the post tion from which we are looking, but we have no difficulty in conceiving of the chair as a solid ob-ject, not to be iden-tified with any one of our two-dimen-sional pictures of it, but giving rise to them all as the posi-tion of the observer is varied. We must is varied. We must now realize that this solid chair in three dimensions is Itealf

only an appearance, which changes according to the motion of the observer, and that there is a super-object in four dimensions, not to be identified with the three-dimensional chair in on the interesting of the state of the state



THE discovery of a newly-perfected bread is the result of extended investigations conducted by the Mellon Institute of Industrial Research of the University of Pittsburgh in direct cooperation with the baking



Our cars belt preduces 48 per cent of the corn cro 46 per cent of our pork, and 25 per cent of our bo

experts and scientific staff of a leading bailing company and a group of retained specialists in food chemistry According to Edward R. Weddlein of the Mellon In-titus, there has been developed and put into viscessful commercial presides a method for the extraction of visualists and subsets staff reem the germ of the wheat berry. These products are justed for enriching white berry. These products are justed for enriching white berry beames. Dr. Weddlein sure late the food value of begand was formerly accordable to the late of the proexperts and scientific staff of a leading baking company

says that the food value ied by chemical analysis, but that analysis falls to tell the en-tire story, the only accurate determina tion being obtained by feeding experi-tments on human be-ings or animals. It was proved that the best white breed, which best with the structure of the con-structure of the con-tructure of

stye diet, will not support life indefin itely. It was lacking in vitamins and min-eral salts. When these were adde great improvement further found necesing in place of



Corn is produced on a very large scale for ensilage pur

lance the mineral sait constituents by the addition of the new wheat germ extract. The new bread resulted, and it is claimed that this perfected product, with only the addition of water to the diet, will sustain life

The significant part of the discovery lies in the recognition that some of our milling processes have been depriving our bread of their vitamins and mineral salts. depriving our leved of their vitamins and mineral suits. The experience it me sailord by the tests is a recently as the experience it measured by the tests is a recently as a supplier (ray) indicated the qualities of that soil, as well as the particular elements to be added to it in the well as the particular elements to be added to it in the well as the particular elements to be added to it in the well as the particular elements to be added to it in the well as the particular elements to be added to it in the well as the particular elements to be added to it in the world as the particular elements to be added to it in the particular elements to be added to a lacking to the addition of the elements to detect as a lacking by the addition of the elements to detect as a lacking by the analysis did not produce the desired results. It is now recognized that the best way to determine what the recognized that the best way to determine what the soil rescle is to experiment with the life that grows soil rescle is to experiment with the life that grows and the soil will realize potates well, it is neces-ory to try growing potatoses on it that is, to "sak the soil." Analogously, in finding a breat that is a com-served to the soil of the soil of the soil of the it as a complete food. Such tests, supplemented by chemical snabysis in order to check up on the exact anture of the modifications made from time to fina, anture of the modifications made from time to fina, ally brought out the desired loaf

Water and the Climate

EVERYONE knows how much more steady is the state of the weather on small islands at great distances from continents than in most other places. Everyone knows how much milder the climate is, how

Everyone knows how much mitter the climate is, how much cooler in summer and warner in witner, at the sensions that a comparatively small number of miles exceed the control of the contro for instance, a pound of water and a pound of almost anything release there are a few substances that are larder to beet than water—and heet them over a cur-vally regulated lame for a certain height of time, and of the late the substance of the late of the late of the rise in temperature of the water is less than that of the other substance. There are a few acceptions, but there are very few. The result is that an ocean or a late aboorts beet, and does not intelled rise very much in

Again, the evaporation of water takes up heat. Every Again, the evaporation of water takes up heat. Every-one knows that. Everyone knows that is order to evaporate water away at all rapidly you must heat it, and the amount of heat that is taken up in this evap-oration of water is greater than in the evaporation of anything else, that is to say, you have got to put more heat into water in order to boil away or to evaporate. heat into water in order to boil away or to evaporate, let us say, a pound of it, than you have in order to evaporate a pound of anything else. Thus the more rapid the evaporation the more effective the resistance of water to the rise of temperature, and for that reason of waiter to the rise of temperature, and for that reason the cooler the climate in the marken region compared to every compared to every compared to every power. This is one of the most important of all commonic factors on the earth. It is a factor that, as much as any other one, perhaps, determines whether for a high and active and prosperous eviluation.— Abstract from article by Professor L. J. Hondorson, Scientific Monthly for November, 1988.





aped to a member of a bridge trum, with its fixed and movable gage points in contact with the tre photographic recording size, the electric light for throwing the indicating beam, and the little mi

The apparatus for detecting the stress actually produced in any member of a brid;

When a Bridge Tells Its Troubles

A New and Ingenious Device for Measuring the Effect of Traffic on Bridges

NEW device has been perfected by the U S Bureau of Public Roads which will be used to be sought by engineers, so that in the future they will be able to prepare designs based on accurate information rather than on the mere attempt to make a liberal

The design of the measuring instrument is b The design of the incasuring instrument is oused on an optical principle, its essential features being shown in the diagram. A and B are the two gage points, A being morehle and pivoted as shown At its upper end is attached, by means of an adjustable fixture, a mirror. By means of a small lens a source of light is forcused us this mirror and is reflected back to a photographic film
In operation, any slight movement of the point A will

In operation, any slight movement of the point A will rock the small mirror about its pivor, thus deflecting the beam of light and very greatly magnifying the orig-nal movement. By thus using a beam of light to mar-nity the movements of the bridge member it is man-possible to elliminate all but two moving parts, namely, the gage point with its extension and the mirror on its pivol. Hince the movement in either case is extremely in the graph of the control of the c

a roll of film is caused to move and receive the record.
This motion is imparight to the film through a train of
worm spars, drives from a small electric motor that is
run by a storage bettery. This bettery also supplies
current to light the filament.
With this instrument it is possible to get magnifications of more than fill of times the amount of the original
defection, but for most cause 300 times has been found



Movement of the sace point A with regard to the fand sage point B enned by the stretching of the bridge trees member is greatly magnified at the super end of the lever whom shorter end forms the moving sage point A. The beam of light is formed by the leve on the malron, whosee it is thrown on the moving film, heaving a graphed recent Diagram showing principle of the recording apparatus



ample. The amount of magnification is calculated by placing the device on a specially constructed block and by means of a micrometer serwy, moving the gase point to a known extent and then measuring the record pro-duced on the film.

Intensity and Duration of Fire

COME experimental work has been undertaken by the Bureau of Standards in connection with investigations of the five-resistive properties of building materials, to determine the actual five exposures to which icerais, to determine the actual fire exponers to which building constructions may be subjected as used to house various occupancies. In furnace fire tests of the control of the control

and storage, with office and residence occupancies at the other and or the scale, as giving the lowest dura-tic the scale of the scale of the scale of the annual behavior of the scale of the scale of the annual behavior of the scale of the scale of the annual behavior of the scale of the s

A New Gasoline-Electric Freight Train

sectal load.

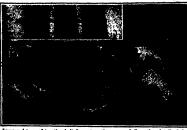
The tractor, which itself carries no userus ionu, is a doublearth evhicle fitted with a 180-horsepower water-cooled six-quinder gasoline engine, rigidly coupled to a 90-kilowati continuous-current dynamo, as well as with all accessories such as electric lights, startor, auxiliary and a canatan installed at the rear The tractor, which itself carries no useful load, is a

self-consocial and activated (1986), as well as with a carbon consocial and activated (1986), and a quantum interibled at the rear self of the fraction of the fraction. In addition to a self-acting vaccina herals, the validication as self-acting vaccina herals, the validication and two descriptions, each of about 15 horseover. The two descriptions, each of about 15 horseover. The two reasons are self-acting the carbon and on rulls—one standard-spage tracks as well as on the wider Russian tracks. The trailer arrived into candidated and the self-acting the carbon tracks as well as on the wider Russian tracks. The trailer arrived into carbon tracks as well as on the wider Russian tracks as well as with the carbon tracks as well as well as with the carbon tracks and on rulls—one of the carbon tracks are tracked as well as the carbon tracks and the carbon tracks are the carbon tracks as the carbon tracks are distincted as the carbon tracks and the carbon tracks are the carbon tracks and the carbon tracks are the carbon tracks as well as w maranta trainer is made up of two pairs of single-nie bogies connected together by horizontal joints and constituting the front and rear cars respectively, which, in turn, are blaned by a gifter. The weight of the tractor is about eight tons, that of the trailer about 10% tons. The maximum traveling speed of the train seven hard roads of medium quality is about 10 february to the seven hard roads of medium quality is about 10 february to the seven hard roads of medium quality is about 10 february to the seven hard to the seven h 10% tous, on level hard roads of medium quality is about 10 kilometers per hour and its maximum climbing capacity is a grade of 23 per cent. All these data are relutive

eight or ten rows in a single trip across the field. The section not only picks the cotton, but gathers it in bags abourd the tractor. The cotton is gathered through a hose twenty five feet long, and all that the operators one to each nozzle—have to do is to carry the nozzle to to the individual blooms. As to the individual blooms. As fust as the operator cun touch the nossie to the cot-ton it files out, passing to the hug in the tank. It is claimed that four operators on the norsies and a fifth on the machine to take cure the air supply can guther at least 5000 pounds of cottor a day

A powerful suction rotary pump is used, handling a large volume of air at low vacuum. Two tanks are em-

shunted from the full one to the empty one in connection with the emptying of the tank of cotton, making it unnecessary for the pickers to stop their work. It is emphasized that the cutton is picked absolutely clean-that it "points out and begins to go" before the nozzle even touckes it, and limit there is no newestly for labeling any leaves or justs of the poil. The entire taking any leaves or parts of the pail. The entire hundling of the cotton after it is removed from the boll is taken care of, automatically, by the machine, which differs materially from others already described



Improved type of traction belt for automotive use, and (insert) a detail of the

the first case since the second will be clear from it. The belt consists of a certain number of links and stretching screws by means of which the assembly can be drawn tight about the wheel. During the rotation of the wheel, the tires revolve upon the inner surface of the shoes, which are successively laid upon the ground. When which are successively into upon the ground. What the shoe has been replaced by the preceding one, its tunnations reach the upper end of their course raise the shoe, and turn it about so that it is ready to be planted in the ground again. At every revolution of the wheel,

by its own weight against the tire, and later will be tilted forward, these two sudden displacements in oppo-site directions will shake the shoe and usually free it from clinging

earth It is the system of suspension involved that is claimed to constitute a simplification of the caterpillar system deed the shape and pro-portions of the suspension are such that the kinematic couple com-

prising trumions and in holes serves not only for placing the shoes in suspension holes serves not only for placing the shoes in front of the wheel and raising them rearwardly, but at the same time for the power engagement of the wheel with the shoes. The weight of the whicle bear directly on the top of the shoes, upon which the wheel will re-volve without any sliding action, and the whole traction strain is supported by said couple and by it alons. We strain is supported by said couple and by it arons, ware oblight to mit various constructional features which have contributed to the practical success of the system. The advantages claimed for the system include the following.

It is applicable to all kinds of wheels, whether driv-It is applicable to all kinds of wheels, whether driving wheels, or combined driving and steering wheels, Given the simplicity, case and rapidity with which the device can be put on and removed, all motor vehicles will be able to use their highest speeds on ordinary will be under the trainer mixing a person of the reads, and at the same time will have at their disposal an apparatus which insures perfect adhesion and allows them to travel and work, away from made roads, upon them to travel and work, away from made roads, upon the worst and nest irregular ground. The motive power is used to the maximum degree partly owing to the cause the roaning loss is limited, whatever the ground may be like, to the gliding of the truminous against the edges of the supersident holes. The use of the device reduces the wear of the rubber trees to a maintanum, as they roll easily and without slighting, spon the metallic

To Disinfect East India Hides

A MERICAN tanners using British Indian hides and skins, reports Vice Consul Hooker at Madras, will Ch skins, reports Vice Commit Hooker at Madras, will be interested to learn that the institution of a lide and skin distincted plant in Madras is evertemplated by a native concern. The proposed plant will be quiltiped to handle about 2000 skins per day. The entreprise when in operation order should considerably simplify and facilitate the direct shipment of raw stock from methera India to the United States.

Another Cotton Picker

MONG the inven-tions of the past few years have been several cotton pickers of unusual promise. That it has always been necessary to pick cotton by hand is well known, as are the enormous economies and the ex-panded production that would result from a machine nicker We two recent attacks upon

we show another This machine is designed primarily to be run from a cheep gasoline engine, since, while electric drive is quite practicable so far as the machine is concerned, it quite practicages to the as the entitle is cleared real, it is not very convenient for use in the cotton fields. The picker alone weight 700 pounds, and can actually be pulled by horse or by hand, if necessary. It is small espough to puss between the rows, and by means of a wide extension bar which carries the suction noxies far to the side of the machine, it can be made to pick



Separate views of the tractor and trailer of the new Austrian gasoline-electric road train

The Centipede Wheel

POWER without traction is proved useless every time a ever wheel spins or sides. The caterpillar ides in one form or another obviously gives the most nearly infallible traction that one can hope for But the caterpillar has disadvantages which have heretofore limited it to agricultural work in heavy ground, where limited it to agricultural work in newly ground, where its advantages outwelft its drawbacks. An Italian artillery captuln, M Guerrini, has perfected the appa-ratus illustrated herewith, designed to bring enterpillar efficiency to road vehicles, di-

vorced from caterpillar cum-bersommens, slowness and multiplicity of parts.

The Guerrint device, in a simple and practical manner, provides any driving wheel with an anti-skid traction ap-paratus which has a large paratus which has a large bearing surface and is light and early removable. It is in fact a vertiable caterpillar in which the rollers, gear wheels and like parts are suppressed, and their functions performed by shoes attacked to the drivand their functions performed by shoes attached to the driv-ing wheels of the vehicle. In the case of road tractors and respectived vehicles these riposi-circa ventices these albes are applied by means of aybeit which can be quickly adjusted and stretched over the tires, and in other cases, h as agricultural tractors. without a belt, by means of independent shoes mounted around the wheel in the way



Elevation and Range of British Naval Guns

Main Armament of Capital Ships Remains Today as Originally Designed and Constructed

By Hector C. Bywater



HE MILITARY value of high elevation in the turret guns of battleships is a subject on which considerable discussion has taken place in the United States during recent months. Public interest was first attracted to Public interest was first attracted to this question by positive statements, apparently enamating from the Navy Department, that British buttle-shipe of the post-Tresty fleet had, on the average, a higher angle of gan sieration than American ships, in vanequence of which the former were able to outrange the latter by several thousand yards. This superiority

of range on the part of British ships was of range on the part of British ships was due, it was alleged, to alterations made in their turrer mountings since the war, or at any rate at some time subsequent to their original entry into service. On the strength of these reports Congress was requested to appropriate funds for mod-erating the United States battle fleet, and emining the United Nates battle feet, and particularly its turrer sun monthings, with a view to enabling the ablige to use their artillers of maximum range, this amounts are desired to the range, the amounts of the range of the range of the amounts of the range of the range of After the month of the range of After the month of the range of After the month of the range of particular the properties of the char-roused, through the usual diplomatic hannels, that no alterations of the char-ter indicated had ever been made in the turnet mounts of any ship of the Royal

terret mounts of any ship of the Royal hold a Nary since its completion. This categorical details was at once sevepted by the surroun tone of Acting Severatory Rossavelic retraction being much appreciated in Ragiand. Apparently however, accuration still previously and the Aray Department that the shoulding range of the British Fleet in higher than that of the United States Fleet, and acis higher than that of the United States Freet, and ac-ordingly it has been proposed to carry out the plan of enlarging the gun elevation of 13 ships, viz. "Florida," 'Ulab," "Arkansaa," "Wyoming," "Pennsylvania," "Ari-sun,, "Oklahoma " "Nevada," "New York," "Texas,"

wan, "Okiahoma "Nevada," "New York," "Toxaa,"
'Missiasippi," "Idaho," and "New Mexico"
It may therefore not be inopportune to outline some
of the technical aspects of this question as seen from

of the feemical aspects of this question in the viewpoint of a British naval student it would be desirable to give all main bat-tory guns the extreme limit of elevation practicable, 4. e., the 42 dex or 43 dex equivalent to maximum range in most cases, if this could be obtained without cures, it this could be obtained without corresponding disadvantages but it can-not Compromise is necessary and the following remarks convey an idea of the factors governing this compromise To glance first at earlier times. In the prolonged naval wars with France Hol-

land and Spain, the truck guns carried in innd and spain, the track guiss carried in the British fleets were given a maximum elevation of 10 deg to 15 deg, and a search through the archives reveals no complaint that this limit was insufficient A larger elevation would have involved a deeper gun port, or else the gun mussle would strike the top sill on recoil. A would strike the top still on recoil A

2 Batts
lower clevation was unacceptable for an
other reason. In the course of the famous
Brights inmouser, the attack from windward, their ships were all listed by the
wind toward the enemy. This circumstance greatly favored the speed with
which a broadded could be fired, diane the
heeling over of the ship provided a natural "ramp" or
notine within cheeded the recoil of the genus and ac-

celerated their running-out after loading. The enemy celevated their running-out after loading. The sensy ship, on the centrary suffered from the corresponding disadvantages. And, in the case of the Franch floots, at ferriner cause of interiority resulted from their testical policy, for whereas the Roy Transit Control of the con-trol of the control of the control of the control of the in the hope of dismanting their exponent. Both highes the control of the control of the control of their grants but the Franch more than the English When, about the middle of the ninescentic centrary, the power of ordinare became to high to be controlled

in truck carriages, allde jountings were intreduced; the gus, on recoil, seconded a fixed sloping path and the gus, on recoil, as colded a fixed sloping path and controlled the path of the slope of the fixed path of the gus and the gus rain up to colonity, while if fired at a high angle the downward bine on the side was excessive. The stonger the colonity with the fired at a high angle the downward bine on the side was excessive. The stonger has the path of the stonger has the colonity of the stonger has been distance the gun recoiled. Eventually it was found consensy to limit the incide not the side to 15 deg, and the sirvation of the gun to 16 deg also. The above system was supersected, as the power of ordinance of coloniance was the size of the power of ordinance of the gun to 16 deg also. The above

IN OUR April issue we atposed the falsity of the propaganda which stated that the naves were not excepting the ships required to be destroyed by the Washington Nared Treaty. We showed that Great Britam, alone, had scraped the cupition dreadmaights condemned under the Treaty and also me the four years since the Armitich had destroyed, voluntarly, a fleet of some 640 battlaships, crusers, destroyers and other archivery vessels. And now, from the same source, comes the statement that perfectious Albien has been surreptiously elevating the gars of the stateships allowed her by the Tranty, with the result that the United States Fleet is today hopelastly outranged. Mr. Bymeste's article shows that from the control of the state of the 14,000-part range of two of our 14-each gan bettlething hoccase of the 34,000-part range of two of our 14-each gan bettlething. Then the advantages would pass to hor, since, with superor appeal, she could hold a controlling range of 23,800 pards.—THE EDITOR.

further developed, by the great Edwick investion of the hydrallic resident first afficient to the page of the page Riswick firm designed turrets whose guns had 40 deg elevation, and several of these were supplied to the

But official naval oninion was in all countries or-ELEVATION AND RANGE OF UNITED STATES AND BRITISH GUNS

mine the effect of these sum part gapes is one of the problems of the introve designer. In Datiest States are problems of the introve designer. In Datiest States are problems of the introvers of the problems of the introversion of the introversion of the introversion of the introversion of the problems of the product of the introversion of the behavior of national management of the product of the internation of the internatio

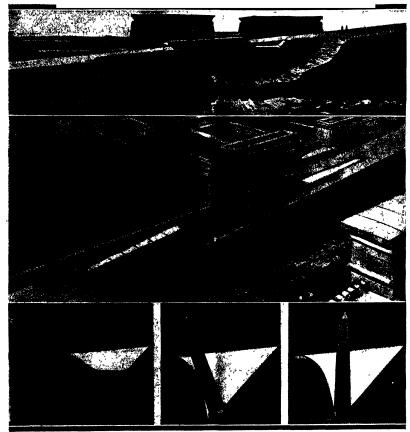
range as warms reply almost mixed almost mixed to the fact that in improving the hitting power of heavy projecties all navies were incidentally developing ranging power to an analysis when the best projecties all navies were incidentally developing ranging power to an analysis which was thought to be far be-

fact that is improving the bitting power in a could be a could be

Longth of Gune Meration of in Californ Gune in Docreas 8 Battleships 2 Battleships 3 Battleships 6 Battleships 2 Battleships BRITISH NAVY

posed to accepting certain positive disadvantages for the sais of obtaining high-ungle fire. The chile disad-tive control of the control of the control of the con-ception of the control of the control of the control of the with the turrer, via, the necessity for a larger gas port. In a turrer the game product through thick armore walls, and to allow them to be silvaried and degleosed to the control of the control of the control of the stacks gaps. The ligher the range of elevation, the greater these gaps must be, and although they may be covered or filled by averence or diding plates of armor, they still remain as highly volumeable patients, "weak joints" in the armore of the gas untreet. How to make

has been mode in the variable for the control of th



THE question of the mechanical means by which the ancient Egyptians set up their huge oblishes, order in a court shorter than the oblishes threif, has large been as the contract that the oblishes than the oblishes than the oblishes will be the contract than the oblishes are reasted, which was recently unsare that lying horizontaily in a grantle bad at Assonant. It is 185 best leads and 14 feet vide at

base. Its weight is carefully astimated at 1163 tens. It has remained for the Orlief Inspector of Antiquities in Upper Engrl, Mr. R. Snipshich, in suggest the Antiquities in the Computation of the Comput

where it was to stand. It was bauled up the ramp or reilers until its base asy over the and pit. The said was then gradually withdrawn through channels below, werked position. The three lower disgrams indicate, but werked position. The three lower disgrams indicate, pit, then the obelisk coming to rest, and lastly the obelisk pulled upright. This ingenious engineering idee may be typical after all, of how the Egyptians carried on much of their remarkable construction work.

Industry in the Philippines

The Golden Opportunity Which this Dependency Presents to American Capital

By Vicente Villamin

HF IAONOMIC progress of the Philippines since American occupation 23 years ago far surpasses that of the three centuries preceding it—It is marked by extension of operations, greater and more standardized production modernization of processes and more coordination in management and marketing. The dvelopment of the country on a larger scale is a

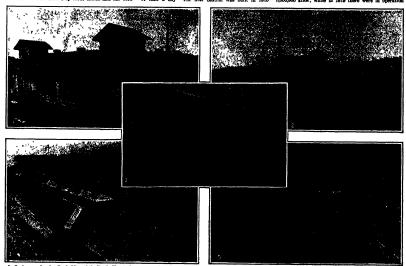
Challenge to enterprise

There are 7000 islands in the Philippine group, which fact makes water transportation vital There are 0000 miles of good roads, 9000 miles of telegraph lines and 900 miles of interisland cables. Distant points in the archipelago are connected with Manila by radio outside world is reached by three cables and one wire

kilos In 1920, 21 per cent of the sugar produced was 96 degrees centrifugal and 70 per cent 88 degrees Muscovado, in the follost lang year it was 86 per cent centrifugal and 64 per cent Muscovado As modern methods are introduced more centrifugal sugar will be produced, which means more returns.

There are still a good number of mimal driven hills and small steam-power mills furnished with side-valve engines. The sugar out-turn of these mills is usually of low grade on account of discolorisation by carmillanor now grade on account of discolorisation by carmilian-tion in kettics placed directly over the fire. The output of modern centrals compares well with the best of its kind in the New York market. There are now 32 of these centrals exected with a capacity of 23,000 tons of cune a day. The first central was built in 1910. charge the ayrup into vacuum pans where it is boiled into crystale. Impurities remain in the monther liqued into crystale. Impurities remain in the monther liqued has been boiled to a proper density the contents of the vacuum pans are dropped into mixer tanks whence they go to centrifugal machines for drying. Moiasses they go to centralized intentions for drying. Moiasses they go to the second of the content of the bagging this ready for export. The ten sent to the bagging this ready for export. The ten sent to the bagging this ready for export. The condition of the content of the con

The ecocount oil is expressed from copra which is dried ecocount must. In 1913 there was only one mill in the islands and the export that year amounted to 5,000,000 kilos, while in 1919 there were in operation



ay 2: A typical sugar ocultul in Lason 2: The current style in trollege in Mantia. 4: The laborers' quarters and (right force 3: Settling tanks, Jules heaters and evaporators which constitute part of the machinery of sugar-case refusition It Car-house and main office building of the Manila Electric Companies of the Santa Glimpses of the industrial life of the Philippines

less system. There is a tonnage of 1,300,000 engaged in cean shipping, while the aggregate of entrances and clearances in the coastwise service is 2,000,000 tens. The foreign trade totals \$25,000,000 venty and the domestic business amounts to \$000,000 OTM; and the The foreign trade totals \$250,000,000 vearly and the demestic business amounts to \$300,000 one of The archipolago has an area of 115,000 square miles with a population of 11,000,000. The total wealth of the country is estimated at \$5,000,000.

The Public Utility Commission has jurisdiction over The Future Unity Commission has Jurisdiction over three railroad systems, one street railway, one gas plant, 54 electric plants, eight water systems, forty tel-phone systems, two telegraph systems, 24 public wharves, 484 automotive vehicle lines and 138 steamers

The first sugar shipment was made in 1795 when about 900000 posseds were shipped to the United States. Development of this industry is steady but rather slow, principally due to Hauted espital. In 1900 the export was 65,000,000 kilos, in 1922 it was over 300,000,000 on the island of Mindoro. The first shipment of cen trifugal sugar, however, was made in 1914 from the San Carlos plant.

critical signs, sowers, was more in loss aron use fitting signs, sowers, was more in loss aron in the Coulow The class goes on a sedies moring platform into the crusher provided with rollers, from here the matter of case passes to the milling plunt proper consisting of a series of roller mills set in tandem The case there is the macerated by the application of water to obtain the maximum surross extraction, the fiber passes are consistent of the control of the country of the control of the country of the control of the country of the countr

45 mills equipped with 259 expeliers and 225 hydraulic prosec from which 146,000,000 kilns of oil were shipped abread. This material goes to the son, margarine and compound lard industries, displacing in a great measure that certain regardles disc.

The state of the properties of the state of the passed through grinders where it is converted into neal which there are no state of the passed through grinders where it is converted into neal which there are no state of the passed to the driver where it is moved on being made to the driver where it is more of a being made to the converted for about 50 minutes. It is supplies mode on the converted through the passed of the passed of the converted to the state of the state of the state of the passed of the state of the passed of the

sea tank. The most important by-product of the oil is the need which contains about 5 per cent of oil and is the need which contains about 5 per cent of oil and The Philippine cores industry is quite important Thee are 88.050,000 excent trees, of which over 47.000,000 trees are in bearing, prieding manually oil 1,500,000,000 mins. In 1821 the copra production contained of 315.000,000 kilos of sundried, 189,000,000 kilos of sundrie oked and 1,000,000 kilos of steam-and hot air dried. Improvement in the copra drying process is

dried. Improvement in the copra drying process in badly needed to place Philippine copra on a competitive basis with that produced in neighboring countries. A profitable industry can be developed out of the husks of the occount, estimated to be 100,000 tons a year, for making outs mats, binder-twines and allied manufactures. Occount shells make fine charcoal and were used in the fibrication of gas massis during the

An industry which is hardly two years old is the estecated coconut used in the confectionery manufacture America alone imports about 40 000,000 pounds ture America amon imports shout evocation pounds a year. This commodity is protected by a high tariff. Hemp made Manila famous. The hemp (muse tealers) because the presential plant and is the most important endeate in the Philippines. The country has a natural monopoly on it, the hemp transplanted with the greatest of care in other tropical regions having produced only inferior and weak fiber Hemp was known as cordage article in 1820 when an American naval vessel took a shipment of it back to America. Although it was locally known for centuries it was not until 1840 when it became an international article of commerce 1921 over 141,000,000 kilos were exported

1921 over 141,000,000 kilos were exported The stripping is done by hand with the aid of a simple apparatus invented by a Spanish priest in 1810 A great number of stripping machines have been in-vented and proved successful in the laboratories but found unsatisfactory for the economical extraction of the fiber under field conditions. The fibers are the o-vascular strands of the sheathing leaf-stalks that make up the trunk. After slitting the fiber producing portion of the tree into strips, these are pulled under a knife applied to a wooden block. The condition of the knife blade, the pressure with which it is pressed and the method of drying are the most important fac-tors that determine the color and strength of the fiber A tree produces a little over a pound of dry hemp Two men devoting four days in stripping and tree Two men devoting four days in stripping and tree cutting and two days in weeding and cleaning the plantation can make about 75 pounds of the best grade of hemp a week and about 150 pounds of the lower grades. The workers are generally also engaged in other call-

Henry is both acid- and salt-resisting and by reason

of the fact that it is the strongest of hard fibers it is intrinsically worth more than what it fetches at the world's markets. It is used for marine rope, towing rope, transmission rope, oil-well cables, lariats, fine es of hinder-twine and allied products. The was grades are manufactured into paper in Japan. A small fraction of the hemp is made into tagal braid for hats and trimmings, and in the Philippines the cloth, hats, baskets and many other articles. The rope-making industry in the country has been started. In this industry one big failure has already

been registered.

The tobacco industry ranks fourth among the wealth-producing activities in the Philippines, with a future that outranks all. The tobacco seeds were introduced by Spanish missionaries from Mexico in the sixteenth century In 1781 the Spanish Government established a monopoly which lasted a century The first Manila century In 1781 the Spanish Government established a menopoly which lasted a century. The first Manila cigars arrived in America in 1818 when an American wind-ismuser, the "Pequot," reached Relem with a story of an engagement with Ohmica pirates which brought the ship to Manila. The Industry is well organised and firmly setablished in 1900, 173,000 cigars were exported, while in 1900 the number was The production of cigarettee is 5,500,000, (,000,000. The prometon of cigaretree in 0,000,000.) yearly The erea planted to tobacco is 91,000 here yielding about 53,000,000 kilos of leaf tobacco is acreage is 86 sper cent greater than the fire-year told of 1915-1919 and 469 per cent than the period 1910-1914. The land available to tobacco growing

F.DITOR.

is extensive The tobacco area is inundated yearly by the Cagayan River which obvintes the necessity of fertilisation

The fabrication of cigars is done by hand. Over The indirection or curary is done by nano. Over 10,000 men and women are employed in the cligar factories of Manila, which look like palaces. The outputs of different factories are standardized, especially as to quality, the dostrament exercising the closest supersistent in the factories. Applicants for work in the tigar factories undergo physical examination and employees are regularly examined the hast sign of aliment is enough for the employee to be barred from the factories until he or she gets perfectly well. The trade in America concedes without cavil that Manila cigars are the best moderate-priced cigar in the market and for this the close supervision is largely responsible.

The tobacco leaf from the plantation is put through

process of curing which takes about three years, at the tobacco is sterilized. It is then loft-dried and put process which lasts about With the ex four months With the ex-ception of the stripping machine no machinery is used. It is not permissible to use molds and the system of "team work" and the use of "suction tables," which accelerate production at the expense of qual ity in other countries, are not known in Manila fac-

COUNTRY of 115,000 square miles and

A eleven million people, against Cuba's 44,000 square miles and three million mhabitants, yet with its resources so untouched that the test of the same and the s

whatisants, yet with its resources so unstouched that its lotal foreign commerce on its most prosperous year was but 270 million dollars, against 250 millions for Cuba on the same year—that is the Philippenes I telimate and soil quite as well suited to sugar-growing as those of Cuba, and in addition equally advantageous for the cultivation of rubbe, it is forth and mountains.

countaining a store-house of timber and mountains constituting a store-house of timber and mineral wealth of which Cuba could never have dreamed—this is the country whose exploitation the present author urges upon us as worth while Can we do other than agree with him?—The

of clean whole tobacco, even the chespest kind are long fillers. Berap tobacco is manu and the rest exported.

The commercial forests occupy about 60,000 square The commercial torests occupy about 00,000 square miles. Three kinds of humbering are in voque handsawing, water or steam mills and large steam mills shoth band and circular types. American machinery and equipments are being used in an increasing degree. The industry is strictly in its infancy The United States market is just getting acquainted with Philip-pine woods in 1921 about 24,000 cubic meters of wood were sent abroad By actual comparative analysis the hardest and softest woods are found in the Philippines. There are varieties that make excellent railroad ties. There are writtened that make excellent railroad tes, one of them, the Ipil, has an average life longer than any crossoted the known. The lumber industry is reciting considerable attention and promises to be one of the leading industries of the country before long

Mensures against defore tation and conflagration are enforced strictly. I um

ber exports are passed up-on by Government experts Embroidery and but in dustries are done by hand dustries are done by hand and exhibit the infinite patience and dexicrity of hand of the Filiphos Al-though only half a dozen years old the embroiders industry is now worth over \$7 000,000 a year, the United States market absorbing the big bulk of the output. This industry is a home industry companies located in the city of Ma nila distributing materials smong workers in their homes in different towns and maintaining a corp of

men to gather finished em brolderies. Cloth is brought over from the Unite States, sometimes already cut up and marked, for embroidering The industry is fast developing, and con producing the unuber of potential workers all over the hillippines, almost every woman being skilled in the work, the future of it must be limitless. The hat in-dustry is also a home industry and is wholly done by hand work Straw hats are made out of buri, bamb

grass and reeds and grass.

Experts have declared that the biggest gold dredging and the richest placer grounds combined with the est methods in the world are located in the Philippines. One of the dredges during four and a half years operation averaged 37 cents a yard for every yard handled which beats all the known record anywhere American equipments are exclusively used Mining and dredging companies in different parts of the Islands report progress and prosperity Silver, copper, iron and other mineral deposits are known to exist and are receiving increasing attention. Asphalt is already exported, mostly to Japan. Coal is being mined and it is stated that before many years the country will stop importing coal Cement plants are working and quality of output is very encouraging Several mineral oil wells have been sunk, high quality oil has been found, but the matter of its commercial exploitation is still under consideration. There are large fertilizer de-posits, and a couple of asbestos works are producing fair quality materials.

The rubber-growing industry is an infant one Com The runot-growing industry is an infinit one Consuperative figures are very libratinating. The costs per acre of rubber linds are Philippines, \$51 up keep cost, \$20 Sumatra \$110, up-keep cost, \$25, Java, \$188, up-keep cost, \$25 Conservative cultimates of yield are 000 pounds for four year old trews, 2.91 pounds for

THE prosperity of the Philippines, Mr

is the aim of his compatriots. As soon as the needed capital comes and the staple industries

needed capital comes and the staple industries are developed, especially those of rubber and sugar, Mr. Villamin feels that his native land will become one of the most important factors in world trade. And his rather imposing lust of Philippine industries that hold out hope for large expansion, evens sufficient to fusify this optimism.

Villamin tells us, is yet to be realized A billion-dollar trade with the United States

eight years, and 6.22 pounds for 12 years. The Heven rubber is what has been found to grow most advantageously in the coun-try The rubber acreage is very small although the acreage suitable for rub ber-growing is extensive, There is a strong movement in America to grow all its rubber requirements in the Philippines. The industry is valued around \$250 000 000 in the primary markets

30 per cent of tannin grown wild in innur

numbers in swamps. Papain from papaya trees is ob-tainable which in color and activity is equal to the best in the market. There are recognized about half a dozen plants as sources of medicine in standard pharm points as sources or mentione in standard paarma-copoela St Ignatius bean visiding stricknine and brucine is grown only in the Philippines, while datura that yields airquine grows invuintly Castor oil plant, croton oil plant kamala and other plants of purpunt, crotton oil pant kamaia and other punts of pur-gative properties grow almost in a wild state Chicle, now imported from Central America, is obtainable in the Philippines in great quantity. The United States imports 8 000,000 pounds of this a year

One great industrial opening is the manufactor One great industrial opening is the manufacture of paper puly for which the raw materials are plentiful, anong then being boundoo, cogon grass, abace weater of the particular high-grade perfumeries from plang-ylang, champa high-grade perfumerles from Jang-jang, champaca, veltver and lemon grans. There is a nucleus of 40 hectares of nullberry trees yielding all k which compares well with the Chinese product in quality. There is now much excitement over this industry which is believed to muca excrement over this manufity which is believed to be another bonanza. Magnes filter of which there is quite an exportation, and rattan and willows are being developed rapidly. The growing of pennut for oil has received great impetus by the steep raise of the tariff

received great imposts in the steep raise of the tariff on it from foreign countries in the United States.

In 1 from foreign countries in the United States.

In 1 from foreign countries in the United States.

In 1 from foreign countries in the United States.

In 1 from foreign countries from with fight, or the States of Suits and other More dignitaries are known all over the world as the possessors of beautiful pearing obtained around the waters of the Island of Mindanno Som the Philippines will not import swellings. Anchories, the Philippines will not import swellings. sardines and the most variegated fish abound undis-turbed in big schools in the limpid waters of the Philip-Shells for pearl buttons are exported to th

extent of 700 000 kilograms a year

The pastoral industry is not as important as it should
be there being only 1 000 000 carabaoas, 800,000 cattle, be there being only 1000 000 carabass, 800,000 cattle, 800,000 carabass, 800,000 cattle, 800,000 posts and 200,000 slavep (communicable animal diseases are presented till the tear around. They are being combated vigorously and are under control. Queerly enough the country has to import about 600,000 doors eggs a year from China and 30,000,000 worth of dairy product from America and Australia Cattle-rating-should be one of the important industries of the country

The alcohol industry (the Eighteenth Amendment is

ot applicable to the Philippines) is quite impo It is mostly manufactured from the sap of the nina coconut tree and sugar molasses. jamil except tree and sugar molasses. There are around 90 registered stills producing about 10 000 000 proof liters a year. There are two ldg breweries pro-ducing around 5,000 000 gape liters of beer a year. Over (Continued on page 11)

Using oil to rout the mosquitoes from the rock nits, their favorite

SING minnows as mosquito policeduca, digaring house drainage ditches that cost messages are more as the minute pursuit police and policy and the minute pursuit policy and policy and policy and policy are declarant partition, mobilition will be a superior of modern sections to eliminate a gracy of modern sections to eliminate and gracy of modern sections to eliminate and policy and the section of the land of our land frontier, those are the effective measures that the Florida State Board of Health and monthoid citius and evidual exceptions are exercising most

manifold civk and private concerns are exercising most vigorously in freeing Florida of one of her most un welcome kuests, the objectionable, onnipresent mos-quito the minute musketeer of the haset world who de-

lights in poking his prickly beyonet into human flesh Throughout Florida, the lowly mosquitoes that breed and swarm over regions of stagnant water have for many mracious for their tribute of blood Floridans have now arisen and united re-sources in the most determined campaign against the postiferous "bloodsuckers" rer waged in Dixie

The mosquito as an enemy to immigration and settle-ment and to sanitation and thealth is going to be eradicated from the land of flowers and winter sunshine before the armaments of

science are again set aside Florida has initiated a State-wide drive which will cease only when the winged stingers that have been a source of disease and menachave been permanently put to flight. Although at least 40 of the 500 known varieties of mosquitoes breed abundantly within the borders of Florida only four of them are feared as obnoxious carriers of disease. Of this quartet of miscreants, the mosquitoes known scientifically as the asdes tribe are the most objection able, being the active disseminators of dengue fever a malady which made temporary invalids of at least 20 per cent of the population of the southern States except Virginia and North Carolina last year The disease is not fatal but it enervates and weakens the patients and markedly reduces their economic accomplishments

This same acdes mosquito is a virulent carrier of yellow fever in addition to being a foe of immigration. That is why all of Florida is now aroused and enrolled That is why all of Florida is now aroused and estrolled in a bonanae campaign to rout the pest. The average mosquito is a semi-austical maritime insect in that the minute fly cannot come into existence without water in which its various stages are passed. Hence the lead-ing cuttrol measure is to eliminate the water logged haunts and dens where mosquitous may breed. In a State like Florida which has more than 20,000 lakes State like Florida which has more than \$30,000 lakes and a cound line that covers more than \$200 tables, it appears the state of the st of the Evergiades, ther have been found in large num-bers inland 30 to 30 miles from the coast while in New Jersey, the busy biters have been discovered as far inland as 40 miles from the coast.
Measultions breed in any standing water, even that in buckets or rain barrels which are often found in the meighborhood of human habitations. The female de-

Fighting the Mosquito

How Minnows, Oil, and Drainage are Freeing Florida of a Leading Enemy of Immigration

By D. H. George

posits from 200 to 400 eggs at a time, which hatch out in from 20 to 48 hours. Gen orally speaking, from 10 to 20 days are required to complete the development of mosquitoes from egg to adult during the

rronn egy to scutt curing the summer mentiles. One interest-ing process in the emergence of the new crop of mos-quitoss is the manner in which the "wigglers" use the old skins of their pups stages as ratts upon which they foat about until they cun stretch out their wings and fly away If there is much movement of the water in the pupa stage, the mosquito will drown That is why the insects seek slow moving or stagnant water as headquarters.

quarters.

The larva and pupe of mosquitoes are air breathers.
They are equipped with short breathing tubes that occur in the end of their talls, which they project through the surface of the water in order to obtain air

The \$30,000 drainage ditch that has freed the community of Perry, Pla., from measuate domination

This breathing method of the mosquito permits the practice of an efficient control measure which is being used largely throughout Florida. It consists in sprink ling or spraying a thin film of oil over the surface of the contaminated water The mosquitoes are unable to the contaminated water. The mosquitoes are unable to push their breathing tubes through the oil film. Their air supply is thus shut off and they drown and die The oiling system is most effective for treating small pools of water in ditches, ponds, streams, boat silps, crab holes, shallow lagroung, fire barrels and large ca-crab holes, shallow lagroung, fire barrels and large catainers of water. Oiling is a

temporary measure and has to be practiced faithfully to se-cure desirable permanent re-sults. The Florida State Hoard of Health has lined up the cooperation of all the garages in the State These garages in the State These service stations save all the oil that they drain from the crank cases of automobiles and give it to the State authorities for use in eradicating the pesky mosquitoes.

According to the Floridan According to the Floridan practices, oil is administered in knapsack sprayers, water-ing pots, drip barrels or cans, oil soaked sawdust or sand oil scaked sawdust or sand and by mop or burlap sticks. The knapsack spray is the most efficient and rapid dis-tribution medium. The sup-

most efficient and rapid dis-tribution medium The supply can will hold five guilons of oil. The operator works a hand pump and can shoot the oil in all directions a distance of 20 feet. The method is especially efficient in eding the edges of ditches, streams and pools. The oil drip cits, placed along the course of a stream or ditch so that oil

seeps constantly in the desired amount from the can into the water, is another efficacious control. The can is usually suspended three feet above the water and the hole made large enough so that from 10 to 20 drops of oll will drip out a minute.

oil will drip out a minute. Sewmills are nunearous throughout Florida and audual to easily obtainable. The mosquitor fighters have
writed out another more control system by soaling oneworked out another more control system by soaling oneplours. The oil asturated sawdust is then "soom" over
the water as one would exterter seeds over the ground
in some cases, burtap bags of oil-exaked sawdust are
unit a stream of oil flor more times which is effective in
killing off myriads of dangerous mosquitons. Oil-exaked
sand dumped by the carticold flor mosquito-conlandnated streams also side in the sholltime of the winaged
of the water while for exercial darry therefore
of the water while for exercial darry therefore, bubbles of the water while for several days thereafter, bubbles of oil rise to the surface, burst and spread rapidly The ordinary minnow is worth \$1 appear in preying on mosquitoes. The Floridans

stock streams and pools with minnows and soon the finny swimmers eradicate the of noxious colonies of mosqu toes. It is not unusual for my as 100 large mosq toes in a single day All that is necessary is that the water be free of lily pads, water hyacinths, matted grammes and other sources of obstruction which will prevent the minnows from pene-trating to all parts of the ditch or stream. Drainage is a permanent

mosquite domination mosquite control measure
that has proved most practical under Floridan conditions. At Perry, Fig., a community where 65 per cent of the population used to menty where to per cent of the population used to suffer from maiaria, a \$30,000 drainage ditch was con-structed some time ago which has eliminated the mos-quitoes and the source of the malarial infections. The quiross and he source of the material infections. The delivery of the community of Peerry from the domina-tion of discuss-spreading mosquitoes has put saw life into the town and has been the commercial making of the surrounding countryside which was non-progressive during the supremency of the mosquito monarchy.



Using the knapsack sprayer on the lawns of Misni, Fig., do season when the mesquitous get their start. As the pict Florida's rainy season fives up to its name

Marine Wood Borers at Work

I IMNORIA. is the name given by scientists to the Los species of marine borers to which these succulential booking individuals belong. While the largest of these bottess are only one-fourth inch long (they are shown beer somewhat magnified), this rapid breeding pest is one of the most destructive of the wood destroyers found on the most often most destructive or the wood destroyers found.

in sait water oria are found on both the Atlantic and The Lessowa are round on both the atuante and partice coasts, subsisting on any untrested wood on which they may find lodgment, the pilling in harbors affording one of their principal opportunities for exis-tence. Coming in contact with the pilling through chance tance. Coming in contact with the piling through chance of tide or drift and lodging on the surface or in cervices, the Lieuworks start a system of interluced burrows on the surface, eating away the softer springwood and leaving the harder wood in rib-like ridges. As the outer seaving the narrow wood in rib-like ridges. As the outer shell of the wood attacked is in this manner reduced to a spongy consistency, and is broken or washed away, the Lieuworks penetrate deeper and deeper until in time the pile may be eaten almost through and semp off er its own weight.

Limnoria are especially hard to combat, owing to the fact that they will penetrate the impregnated portion of treated wood through the least crevice or abrasion and occusionally attack treated wood that may have leached out to a low toxicity

The United States Forest Service and its subsidiary, the Forest Products Laboratory, are cooperating with other agencies in efforts to find effective chemical or mechanical treatment which

chemical or mechanical treatment which will make piling immune to the attack of marine wood destroyers. This is one of the most interesting of the many fields of activity entaced by the Forest Service in promoting timber conservation

Shop-Made Lawns by the Yard

NO longer need the impatient golfer whose club is a newly organized one. I whose cits is a newly organized one, or whose course has had to be removated, wait weeks and months for the grass to grow to the point where the permanent greens may be used. Factory-made greens may now be bought by the yard, and laid down in their full velvety growth The same service is available for grass tennis courts. A British "pro," J MacDonald, of Harpen-den, Hertfordshire, has perfected a method of sowing grass seed on a special fabric in a "factory" where the temperature is siways that of spring or summer Car-pets of green grass are thus produced and when these are laid down on flattened and went nees are alsa down on nationed surfaces, the fabric rots away and the roots become incorporated with the soil Lawas thus made can be played on it a very short time. Moreover, by a somewhat different method, a lewis for immediate play can be made. In this case the need is sown into wooden truys with a fabric bottom. These can be



Catting into lengths the factory-made grass carped for golf grooms and tennis lawns

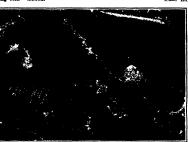
transported in a crate and dove-tailed together, thus producing a green lawn which can even be laid down under cover. These same kind of prace rups were em-ployed during the World War for the camountaging of

How Sharp Is a Needle?

Mow Sharp is a Needle?

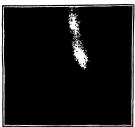
O'W offer heave the expression "An sharp as a was," but in nature this real temperature of the secondary of the second while the stinger is perfectly smooth and still sharp Further than this, something of the workmanship of nature will be realized by the fact that this tiny shaft anture will be resilized by the fact that this timy shaft is not solid, as it would appear, but contains a duct or interior channel through which the poissn secretion is injected into the possible victim. The poisson is supplied from two sacks or glands. The one known as the mid gland is supposed to contain

formic acid, the other suck secretes alkalin, and it is the mixture of the two which forms the poisse. It is this poison secretion injected into the flesh, and not the puncture of the stinger, which causes the intense pain with which the most of us are more or less pain wi



The thing that makes our wharves short-lived—a colony of wood borers at work, under a magnification of about fifteen diameters

Compressibility and the Size of Atoms Ounpressibility and the Size of Atoms of Size of the most introving sub-set discussed the Advancement of Science at Cambridge in December and was that of the size of tenderdige in December and Size of the Size of tenderdige in December and Size of the Size of tenderdige in December and Size of the Size of tenderdige in December and Size of the Size of It was supposed that in the compression of the solid the atoms are merely forced closer together, without any distortion of the atoms themselves, About 15 years ago Professor T W Richards of Harvard Uni versity began to develop the distinctly novel idea that the atoms occupy most of the space in a solid and that in any considerable decrease of volume the atoms them in any considerable decrease of volume the atoms them selves are diminished in size. This gave rise to his celebraried theory of 'compressible atoms.' In 1921 Professor Richards showed that the dimensions of atoms could be calculated from the compressibilities of atoms could be excluded even to the consequence of speaking reactive of the results in that diameters of the atomic aspecially those of the metals, proved to vary with the nature of the compound in which they are found. Thus the sodium atom is smalller when com-bined with chlorine (as it is in common suit) for which it has a high affinity, than when it is united with



ordek. J Q. Posts
A needle point (left), and that of a bee's stinger,
photographed at 400 diameters magnification to
show the relative crudity of the former

bromine or todine, for which its affinity is less. ssor Richards' most recent work has been to devise

a new and more directly experimental method for calculating the dimensions of atoms, with the remarkable result that atoms, with the remarkable result that the values obtained are the same, within the limits of error, as those given by the older method. The new method depends upon the idea that the element sodium, acts under compression exactly as potas-sium would at under high pressure. The attentive forces is tween the atoms is such that the internal pressure in sodium under ordinary conditions is 20,000 atmospheres higher than that in potassium By sing the data on these two elements he is able to show how the contraction which occurs in the formation of a sait from the elements may be distributed betw The results throw much light upon the mechanism of chemical combination, the magnitude of the internal pressures involved and many allied phen

The Present Conception of Matter I T is probable that in the stars there is A going on a transmittation of the ele-ments, more complex ones being built out of the atoms of hydrogen the simplest of all, while others are thems lives dish tegrating. And what is going on spon taneously in the stars has actually been

accomplished artificially in the last veur or two by Sir-brnest Rutherford in the Cavendish Laboratory at Cambridge Although, as vei, the total amounts of subatomic energy he has liberated have been minute, they are enormous when compared with the quantities of matter affected, but it must be added that there is no evidence that we may tap these stores of power

It is for such reasons that during the last few years, our conception of the nature of natter has entirely changed. The nineteenth centure dispelled the hazy ideus of the sk hemists. New elements were continually being discovered and the more exact investigation became the more likely did it appear that the ments and those previously known were the ultimate materials of the universe. More than 80 elements became known. Mendeleeff had found it possible to arrange a periodic scheme by means of which undiscov cred elements could be predicted to fill the blank spaces in the table, and subsequent discovery showed how ccurately the properties of such elements had been orctold. Later on Sir William Crookes thought of the foretott later on ar within crookes mought of the evolution of the elements from a fundamental some-thing which he called a 'protyle a hypothesis orig inally advanced by Prout in 1815. But with the advent of the twentieth century came the greatest change From many sides attacks were made on the idea of the mutual independence of the elements each of which had been supposed to passess precise and exclusive characteristics. It was shown that elements existed in which the atoms were not all exactly allke although the different specimens of such elements were chem ically indistinguishable from one another these were named "tsotopes" by Professor Soddy Lead, for example, is one of them. This substance may be obtained in several different ways to the chemist it is always lead, but its atomic weight depends on the way in which it has been derived



tting the 3300-pound capstone, Dec The staging is supported from the windows on each face

This view was taken when the surface soil had been removed, uncovering the original rubble stone foundation, preparatory to understaning

Underpinning the Washington Monument

Enlarging the Foundations to Carry the Five Hundred and Fifty-Foot Shaft

THE Washington Monu ment had been built in the days of the ancients, it would have formed, doubt less, the eighth "wonder of the world" Even today, in this age of big constructions, it sta

Among the millions of American citi zens who have looked upon this noble memorial to George Washington, very few meaning to transport assungate, very less are familiar with the story of its crection, and we owe it to Capt D L. Weart of the Corps of Engineers, United States Army writing in the last issue of the Milliary Engineer, that the following account of the erection of the Monument had been made public. The following article is based upon his most interesting story and to the above mentioned journal we are indebted for our illustrations.

we are indented for our illustrations.

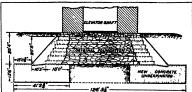
The first movement in the direction of building a monument to Washington, was made in 1783, when the Confinential Congress authorized the erection of an equestrian statue to be erected where the sent of congress was established. In 1791, I. Enfant provided in levation for the statue in his plan of the city of

Shortly after his death in December, 1799, Congre

Shortly after mix neatm in Sectioner, 17ms, 'congress, on the motion of John Marshall, provided for the erection of a marble menument in Washington, and requested that the family permit his body to be deposited under it. The subject was brought up again in 1816, and in 1819 but nothing definite was done although about noting centric was done atmogn about this time a vault was prepared for Wash ington's remains beneath the floor of the crypt under the dome of the Capitol James Buchanan in 1824 and President John Quincy Adams, in 1825, brought the opestion to the attention of Congress but still no action was taken. So much for the remembrance and veneration of Con-

Fight years later, in 1838, some in-fluential citizens of Washington, hopeless, apparently, of any action by Cangress, formed the Washington National Monuformed the Washington National Monu-ment Society with Chief Justice John Marshall as president and a campaign was started to secure funds. Three years later, designs for a monument to cost 37 000 000 were invited, and the competi tion was won by Robert Mills, whose plans tion was won by Robert Mills, whose plans called for a circular colonnaded building, 250 feet in dinneter and 100 feet high with a 500-foot shaft raising from its center. The colonnade feature was never

Twelve years later, in 1848, Congress authorized the society to erect a monu-



Cross-section showing the walls of shaft 15 feet thick, the original foundation of the new concrete buttresses resting on a hollow, rectangular slab, meaning 136 ft 5% inches on each side

The underlying strata was very compact, and at the depth of 20 feet, a solid bed of gravel six feet deep was encountered. The original foundation was 80 feet square at the base, 23 feet 4 inches deep, built in

ment to the memory of George Washington at the present site, and the corner stops was laid on July 4 1848, at which time the society had collected \$88,000 towards defruying the estimated cost of \$1,000 000. The foundation conditions were found to be good.

pyramidal shape with the sides steeped, as shown in the illustration. It was built as sides as the side of the state of th Five years passed and then, in 1869, Congress passed an Act incorporating the Washington National Monument Society for the purpose of completing the erection of the monument. The Secretary of War appointed Lieutenant J. C. Ives, Corps of Topographical Engineers, to superintend ropographical Regimeers, to superintend construction He examined the founda-tion and reported that it was entirely satisfactory Shortage of funds delayed the work, until Congress took action and

to and reported that it was entirely ab, measurmidiately "Ministrage of funds delayed and indicately and the secrety This was a lifety and the secrety This was a lifety, and in 1874, on the recommendation of Jacutenant W F. Marshall, Corps of the height of the shart should be reduced from 600 feet, so as to avoid excessive pressure on the soil to 600 feet, so as to avoid excessive pressure on the soil on 600 feet, so as to avoid excessive pressure on the soil of formation. It was not until August 2, 1876, that the thing was done which should have been done many proved an act. It was not until August 2, 1876, that the finite was done which should have been done many proved an act which provided that the Gormany proved and the should take over and complete the errection of Engineers about Appear on the suit-fielent to carry a shaft of the proposed by the shape of the shape of



The underlying slab and sloping buttress completed, ready for rediling the soil to the base of the shaft

A Canal that Grows Crops in a Barren

ONE of the most curtous enails in all creation is waters of the Mailed River in southern Idaho to the King Hill Irrigation project in the Snake River Valley Without water for irrigation, 17,000 acres of and in that neighborhood would be practically sworthless. How-

ever, with plenty of moisture available, the locality will produce insuriant and profitable yields of every ecop that can be raised in the property of the pro

alored of any of their riveni. The water of the Maind River is diverted into the count at a point one mile count at the point of the maintenance of the Maind The main large finne in the Canyon of the Maind The main a large finne in the Canyon of the Maind The main count is a finne long, five count is a finne long, five count in the count of the Maind The main shows a finne of the maintenance of the Maind The maintenance of the Maind River Maintenance of the Western Irrigation channels of a perma near it nature. The most extensive of the western irrigation channels of a perma near it nature. The most extensive of the western irrigation channels of a perma near it nature. The most extensive of the western irrigation channels of a perma near it nature. The most extensive of the western irrigation channels of a perma near it nature. The most extensive of the western irrigation channels of the western irrigation channels of the western irrigation and the state of the most extensive of the western irrigation channels of t

out the irrigation seems which lasts 193 days is adequate Plans are now under way to construct emergency water storages as sources of emergency moisture during

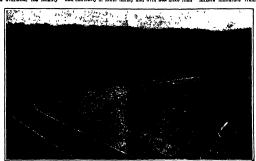
almormal seasons. The irrigation of the Snake River Valley has not only provided homes for a great number of citizens who, otherwise, would have been unable to obtain farm homes, but if has also created taxable values in excess of the entire cost of the project. These values are of

of the entire cost of the project a permanent character and will endure and be a perpetual beseft to the country of the control of the country of the country of the country of the canal is very crooked and tortunes, as is shown by the free that the waters of the canal is very entire that the waters of the country of the

The King Hill Canal is in teresting, insamels as after the private company that originally owned it failed. Uncle Seam took control of a million dollars in improving it and now has developed it into one of the best small water projects in the Western States. He has built and is testing out the efficiency of the control of the control

constate of wood, monotiche, guntle, guntle and concrete and conditions of the concrete work directly at the scene of monotonic and concrete work directly at the scene of monotonic and concrete work directly at the scene of monotonic and concrete work directly and concrete work directly and concrete work directly and concrete work directly and concrete and concrete work directly and concrete and concrete work directly and concrete and concrete and concrete with a concrete and concrete and concrete with sections of burian scaled in tar Altogetishe more than it sightess here and to be built

which range in diameter from 48 to 100 inches. The gualita method of construction which features the use graphs has proved particularly substancing under dragrapato has proved particularly substancing under draculustances where any leakage of water which occurred substances where any leakage of water which occurred uilget damage the foundation of the time. The gualite fautor is very durable and wear-overby devote that its damage of the contract of the contract of the contract and efficiently in long ranging and with fees labor than and efficiently in long ranging and with fees labor than



A piece of the 52-mile canal that carries the mountain waters of the spring-fed Malad River to the irrigated farms of the Snake River valley

any other type. It promises to play a prominent part in revolutionizing flume construction

Harnessing the California River

O E of the latest of the Culifornia irrigation works completed ourly this spring. The dam, which was completed early this spring. The dam, which is situated ten miles above La Grange on the Taolumnes River, is believed to be the second highest irrigation.

irrisoted land for application to lighting and power As will be seen from our illustration, the dam is being built in a series of great streps, and an interesting fisture of the work is the method in which gravity is used in placing the councrle. At or slightly above the level of the creat of the dam are large mixers which turn some 2000 tons of gravel, and and comment into 1800

yards of execute on every working day. From the mixers miniature trains, driven by gasoline motors, earn; the liquid concrete out upon the completed portion of the evest of the dam from whence it is conveyed in a series of feetiles pipes down to the nextly evereted forms of the entry of the converse of the converse of the converse from the converse which is built as handled of the converse which is built as the converse of the

Within the body of the dam itself are 4900 feet of auxiliaries leading to valves which regulate the flow of irrigation water These auxiliaries extend in four horizontal planes.

sontal planes
The lake above the dam
will cover one of the historic spots of Cultivaria's
gold mine days. Don Pedro
Bar a mining town from
which thirteen million dolhars worth of raw gold was
shipped through the Wellsbargo express office, alone,
cast fitteen hundred votes in
1890 when I In a all n was

Fargo express office, a done, not fitted hundred votes in 1860 when Lincoln was elected President. The town was destroyed by fire in 1844, and as the gold had been taken out by that the it was never rebuilt, ultimately its site will be buried under 105 fect of water.

Quantum Mechanism in the Atom

A Ta meeting of the Royal Society of Ediaburgh on A May 8 Professor E T Whittaker read a paper on the quantum machanism in the atom Professor Whittaker shows that it is possible to ex-

upon the completed portion satisfactorily in terms of the classical electrodynamics without postulating any structure in the atom be-sond that by which it is customars to explain induced nugnetization. The auan approaching electron in producing a "magnetic current in the atom, up to a certain velocity of approach the electron does not get legond the atom but suffers an "electron product in the control of t an "ciastic impact" which repels it without loss of en When, however, the elecity of approach exceeds this critical value the elec-tron passes through the magnote atom and gives to it energy of exactly that amount or quantum which corresponds with the critical velocity The transformation of this energy into radiunt energy can be explained by generalizing the conception. thus the magnetic current charged condenser, purtak-ing of the nature of a becomes equivalent to a simple mathematical process, combined with the assump-



General view of the Don Pedre dam in California, said to be the second highest irrigation and power dam in the world

and power dam in existence, overtopting the function towards dam at Powerls Artison, by several feel It is 283 feet high, 177 feet thick at the baw, 16 feet to excess a consequence of the length. It will serve to create a reservoir covering \$276 acres, and will store \$2,000 acres-leed of water and serve to Irrigate 105,000 Alan, its waters will serve to develop 17,000 horsepower, which will be distributed among the owners of the tion that the oscillators in the atoms are similar to each other in structure and differ only in sain, the equation $h = \Omega$ can be established, giving Planet's relation connecting the frequency 1, of the emitted radiation with the amount of kintle energy Γ inherical from the moment of kintle energy Γ inherical from the same of the inherical from th



pring the tile it is retreated recovery that to protects or lead reversals of sizes is introduced. As tile of small financies or necessition, below that is assessed over, in the case of terms the financier of the gradient is time safety extincted by relating all the interest? gradient is time given the cross-hors and the tile must be pixed at uniform distances below it. This deviate the work from the distance of the continuous properties of the continuous properties of a long crower. For it is endined and time of the continuous properties of the continuous properties of the safety of the continuous continuous properties of the with the safe of an easily assessed to the safety of the distance of the continuous properties of the continuous properties of the with the safe of an easily assessed to playing tile on the continuous properties of the con

Draining Land With Gasoline

How the Scarcity of Labor has Brought About the Use of Machinery for Marshland Ditching

By S R. Winters

AKING no account of vast areas of over-and swamp lands subject to the matton facilities of private and gov-ental agencies, there are 43,873,000 area of farming lands in twenty-eight American States whose crop-producing powers could be enhanced by drainage. According to sectional distribution, tile could be buried advantagesectional distribution, tile could be burlet davantage-omly along an expanse of territory embersing 22,250,000 acres in ten Monthern Stitus, there being 0,000 000 acres that the section of the section of the section of the Monthern States understinage would quicken and increase crop jukids on 12,200,000 acres, while in an equal number of Northern States tenending another try would redound to the basedtes of 8,417,000 acres. This affests computation, data hitherto unpublished,

is based on an investigation made by the Drainage Division Bureau of Public Roads, which serves to invision turrent in behalf of adequate drainage as well as to emphasize the achievements already credited to modern machinery and methods in removing excess water from agricultural areas. Over against the background of the compilation relating to the vast regions in need of tile underdrainage in the encouraging accomplishment of ditching mechanism in four Middle West States—Ohlo, Indiana, Illinois and Iowa—where the work has been so all-embracing as to render difficult tion work mis occur so att-emoracing as to render difficult any reliable calculation as to the untouched farming arres. Progress in this group of States is unmistabile, and where accumulated moisture has not been displaced and where accumulated moisture has not been displaced the agencies of organised effort are well on toward the execution of systematically defined plans. One county in one of these above-mentioned States supports 200 drainage districts, while still another

Marked innovations—although seem-ingly slow of evolution—have been in-augurated since the auspicious day in 1885 when John Johnston laid the first drain tile in the United States, the event drain the in the United States, the event taking place in Ontario County, New York Significant it is that 84 years later—in the spring of 1919—not far removed from the spot where the historical tikelaying was commemorated, furners pooled laying was commemorated, farmers pooled their interests, organized a company, and cooperatively acquired a power-trenching machine. The methods employed by Mr Johanton are mainly in vogue in this particular locality. Elsewhere a larger diameter of tile has been instalted, the two-inch measurement having been abundoned for measurement having been abundoned. elkiently organized drainage districts of the Middle West, tile of five inch diameter is favored. The reason for the larger tile is obvious, inassuch as any irregularity in the make-up of small sized drain for convey ing off the accumulated water is decreased in propor-tion. The variously shaped tiles of former days—distion. The variously shaped tiles of former onys—ontinctive among the types being the horseshee tile with
a fint bottom, either open or closed—have been superseded by those of a cylindrical shape, that is, with a
round bore In recent years, concrete tile has come
into extensive use, its adaptation having been very
widespread in the Middle West However, the popularity of clay tile is not to be minimised.

The veteran dicher-whose prediction for the use of the simple stude had its source in other lands than America—in fast disappearing, according to the drainage engineers of the Bureau of Public Roads. Attractive wages in the city, shortage of labor in more profitable occupations, and economic disturbances are probably the causes which have speeded the going of the immigrant who obtained his knowledge of the rudi ments of ditching "in the old country". His departure ments of directing in the office of the state of the has been capitalised mechanical ingenuity has worked at top speed, and the development of a multitude of tile trenching machines, operated by steam or gazoline engines has been the fortunate result. Instead of the engines has been the fortunate result. Instead of the laborious hand method of installing a system for fa-cilitating the flow or excess water, mechanery digs the treach to the specified depth at a single operation. The types of implements vary from the inexpensive ditching jow, costing from \$20 to 8000, to the costly equipment designed for contractors and large plantation owners, entailing an investment of \$9000. D I. Yarnell, scalor drainage engineer of the Division of Drainage Investigations, summarises the three requirements of a good treatching unseither I should operate efficiently in all types of white, should be expanded to the control of white the control of or ascered exervating buckets are best satted to sticky solls, while solld buckets perform efficiently in loose, dry solls. Obviously strength is a prerequisite for a unchine that would labor in shale or steay ground-lest the barrenness of its results should be like the scriptural sowers of seed, its efforts being non-produc-eriptural sowers of seed, its efforts being non-produc-

According to classes, treaching outiles are four in kind, plows, evoops, wheel excevators and endiese chain excevators. The names of the first two betruy their natures. They are operated by horses, and they free control of the cont

could not be afforded. of handwork is require on council travel. The or of this type of equits with those of the elabor

A herse-drawn ditcher for shallow tile ditabase



Concrete in Surprising Places

I employing the princi-ple of the arch, large been may be roofed over the use of reinforced con-crets; and this method is especially applicable where it is required to construct sero-blads having a considerable size. For airship use, the question of the height of the structure is another facwhich enters into the consideration. A good ex-consideration. A good ex-ample of recent practice is shown in the large zero-shed which was built for the French Navy at Montebourg

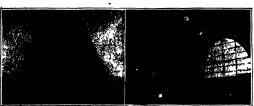
by the Fourré-Rhodes establishments, according to the plans of Businer Lossier The outside dimensions of plans of Engineer Losser The outside atmenture are, length 500 feet, width 188 feet, and

height 100 feet, the structure, the portion which forms the rault is stay says the front he side or uniquity part of the structure, but to the eye, the whole has the appearance of a uniform construction, and as will be observed in our engraving, the principal members are spaced along the instant of the shed and have a general periodic lewer part consists in reality of a girder of trianguist shape, sharing on the inside a fartight or vertical beam and on the outside an inclined beam, these being considerably spaced apart at the bottom to form the base top, the whole height considerably spaced apart at the ottom to form the base top, the whole heigh guiltably cross-braced. On the top of this substantial girder which may be likesed to a half-tower, is mounted the relationed concrete beam which is curved into the spaceral shape of the vault, and it rests on the base portion through the medium of a treate on the base portion through the medium of a proped for this cakes of structural work and termed semi articulation, and in which the unreal rods form practically the entire connection between the parts. Is principle, the portion which forms the seem arranation, and in water the initial rolls form practically the entire connection between the parts. The main girders of the structure being thus obtained they are cross-connected by the longitudinal portions which run along the whole length of the shed, then a special slab of reinforced concrete of light and strong make-up is laid over the spaces in order to cover the building.

building. The triangular upright members are spaced in pairs at 80 feet representing the inside width of the shelf at 80 feet representing the inside width of the shelf at 80 feet representing the inside width of the strength and the inclinate bosons contains at a side of the strength and the inclinate bosons contains at a side of the strength of the shelf forcing bears of round from. At the bottom of each is a good stade base of their feet three linches square the residencing harr passing down through the base and the upright are moded and flowed with concrete on the spot, being spaced along at 10 feet 6 inches between centers, but the horizontal connecting beams are made up at the works, leaving the bare projecting out at the works, leaving the bare projecting out at the with the works and the strength of the strength of the works, leaving the bare projecting out at the within the works in sentence while these latter are being with the works in members while these latter are being ends of these pieces so as to be able to make connection with the vertical members while these latter are being formed. The cross members have a general square shape, but are given a channels be section for the nits of lightness, the feet side being turned outwards, this spaced apart at six free from tunches on the helder of the shed, these beauss serve also to support the flat covering stabs. The top or arched pertion of the shed contains of beams formed in special special

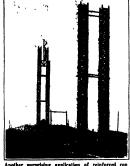
bers upon which they rest by the semi-articulations, an-other joint of the same other joint of the same character being provided at the top of the vault One of the original feat-ures of the new construction

is the use of a large flat the use of a large meeting slab which was de-ned by M. Minard, and it of unusual size, measuring of feet by 5 feet 6 fast. These reinforced screte slabs which are simply laid upon the struc-tural beams after the man nor of the customary roofing e clustomary roofing



Outer and inner views of the end of an aero-shed of reinforced concrete, a recent French design

quires to be covered, and may thus find numerous ap-plications. There need no longer be any apprehensions as to an excessive weight of material when it comes to applying reinforced concrete for the sides and especially for the rooting of structures, and especially in the case of large sheds for airplanes or airships. A very light weight is obtained for the present type of roofing siab. In spite of its large size it can be made



Another surprising application of reinforced con

as thin as 0.4 inch, and the metal reinforcing portion consists of wire gause with very small mesh. As noticed in the sectional view, it is formed with a stiff raing or ribbed portion along the sides and has two additional ribb of suitable shape at the middle part The top and bottom parts are given a suitable shape for applying the slab upon two of the cross beams of ture, this method being very simple and con

tate the handling of the slab, which weighs about \$30 pounds, the lower iron say pounds, the lower from red which is used for rein-forcing the middle ribs is made to project somewhat at the top of the sish and has the shape of an eyeler, and this also aids in secur-ing the slab to the crossbeam Tests for the strength of these reinforced concrete slabs are made by supportslabs are made by support-ing them at the ends and loading them over the whole surface with sand, repre-senting the weight which the slab is required to sup-

These interesting sheds de not by any means exhaust the novel uses of reinforced omerete, which are in fact being added to almost every day Just as a further example may be mentioned an other French development which involves the use of this type of structure for towers of extreme height. Radio eers especially are being built in this way, and are attractive in appearance as well as substantial. Tem pests will not blow them down, as was proved by some of the high towers erected at St Pierre What is a or me mgn rowers erected at St. Pierre. What is a novel festure is that the tower can be made up, say of 15-foot lengths, which are formed on the ground and then holsted into place. This means much quicker work than when a steel tower has to be built

Poisoning by Illuminating Gas

Tills only constituent of libunihating gas which has farefoux poleutious properties is carbon monoxide for the property of forming a dissociable compound with the hamonolobin of the blood just as has every gar but the utility of carbon monoxide for haemoglobin is about 240 times that of oxygen for haemoglobin. The greater the extent to which the haemoglobin becomes combined with carbon monoxide the less is its capacity to act as a carrier of oxygbetween the lungs and the tissues of the body, and if a sufficient amount of the inemoglobin in the blood becomes combined with carbon monoxide the normal oxygen supply to the tissues must evidently be seriously affected. The effects produced by severe carbon monox ide poisoning are in fact, those of slow or rapid asphyx-

The minimum concentration of carbon monoxide that will prove fatal is not known with certainty, but th available evidence points to the conclusion that death will ensue after an exposure for several hours to air containing 0.2 per cent of the gas. Much depends on the length of time that the blood has been highly sat the engin to time time monoid and new many may trusted with earlson monoidle, for the longer an extensity shortupe of oxygen is maintained the more sclouds the damage to the thesares of the body, per fleularly to the nervous system and the more difficult is recovery. Bearing this in mind, it is not improbable that 0.15 per cult of arison monoide in the air breather might prove dangerous to lift in the case of prolong exposures, according to Nature.

Exposure to relatively high concentrations of the gas leads, of course to rapid loss of constitueness and death, but in accidental cases of poisoning the concentration of carbon monoxide is, as a rule, comparatively low and in these circumstances the onset of symptowill be gradual though progressive for the gas, owing to its low concentration, will

diffuse but slowly into the blood and it will be long before complete gaseous lished between the bloc the air in the lungs. Herein lies a great danger, for so insidious is the onset of the symptoms that the person affected may not realise that anything is amiss until he has lost so much of the power of his limbs as to render it impossible to with draw from the danger With 01 per cent of carbon mon oxide in the air breathed a resting person will become and a half with 0.2 per cent in little more than an hour, and with 04 per cent in about half an hour



The concrete acro-sked from the side, during the process of construction



Solving the Street Traffic Problem

Speeding Up Traffic by Separating the Through and the Local Traffic the persons of sirectest libra as the 10.

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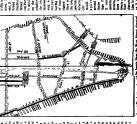
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Digging in Sacred Soil Research With the Spade in Palestine Since the War REAT Britain



The well of Harod, where Gideon selected his braves

protection of the historic menun the country, the arrangement of a na tional numeum, and the organization and control of excuvations and research The

Government properly regards the admin-istration of the antiquities of Pulestine as

center for research and advanced study. Sir Herbert Samuel, his Majosty's first High Com-missioner for Pulestine, created, as one of his first official acts, a Department of

jected for the next season. No fewer than sight properly equipped expeditions are at work add the risults of this combined effort genuine to be flar-reaching. On the contern side, in the Jordan Valley, at Ala Don, near this property of the contern side, in the Jordan Valley, at Ala Don, near this property of the conternation of the property of the content of the content of the property of a monetal transpose of the thrie content prevents of an ancient prange most the thrie content prevents of an ancient prange became the transpose of nancient Jerich Considerable clarkmens were made here in the course of executions made in other days delicating with of undoubted antiquity, both those of houses and main walls of the city. But the historical content of the course o minutie which modern acteane tent due regard to minutie which modern acteane demands, and there lacked then, as now sufficient comparative material, properly collated and arranged, by which to deduce the full and logical results from the work done. Doubt

less some learned society will come forward in the future to undertake the task in a modern fashion. Further north is lieisan, the "Key to Palestine," dominating the junction of the valley of Jearcel with

that of Jordan. Here the, University Mu-seum of Philadelphia has commenced work on a well-conceived plan under the able direction of Dr Figher, backed up by Fisher, backed up to resources proportion resources proportionate to the undertak-ing, and rewarded at once by historical dis-coverias. Further west, in the plain of Radraelou, is Megidio, overlooking that most historic battlefield the mem-ory of which survives in the suggestive word Armageddon.



Part of the ancient wal

The views shown on the facing page are as follows: Into views satural to the loss of Gallies. It Where Christ "in the action trow of Thorins, so the Sea of Gallies. It Where Christ "intered into the grangerse and tangist" in Capernaum. It Armagedess, the symbol of world conflict. At Where Samon carried sways the gran and polled down the temps of Geas. St The port of Casarras, cone the Roman captint of Palestina. St A field of Miletal disaster, where the abled of Saul results of Aleston Carried, and the Jordan valley Some Historical Carried, gait the Jordan valley Some Historical Carried, gait the Jordan valley Some HISTORIC SCENES IN FÂLESTINE THAT ARE NOW BEING LAID BARE BY PICK AND SHOVEL OF THE ARCRASOLOGISTS

a trust confided to it by the whole wo accordingly, an International Board, of which the Director of Antiquities is which the Infector of Antiquities is Chairman, advises the Department on all matters of public interest. This board includes representatives of the different communities, and of the societies of foreign countries engaged in archaeological foreign countries engaged in arraneouscur-research in Palestine
The first fruits of this new endeaver
are now becoming visible Professor John
Gurstang, D Sc, of Increpool University,
stress through The Historical London
Nesse, an account of the progress of his torical research, and the protection given torical research, and the protection given to ancient remains in the Holy Land, un-der the established British regime. Pro-fessor Garstang is the organizing director both of the British School of Archeology in Jerusalem and of the Department of Antiquities for Palestine he writes with the authority of scientific experience and the authority or scientific experience and those who map have entertained doubts as to how far political and other consid-rations might affect Great Britains fol-flinent of her trust in regard to the antiquities of the Holy Land, will be re-assured and gratified by the professor's

t u i i of her responsibili-ties in Palestine,

both as rega

protection of the his.

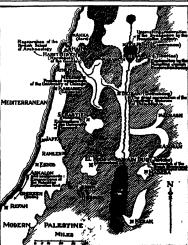
and at Rome) was founded in Jerusalem

assured and gratified by the professor's definite accounts.
Special manuments, like the great Crusider's Fortewses of Acre and Athlit, the Roman city of Cassarse, and the Philietine site of Askalan, have been put under guardians, and museums are being organised where all the local resultain any be proverved and studied. A central he preserved and studied. A central museum has been established in Jerusa lem, with a distinguished Oxford graduate as keeper, and already the framework of a representative collection is open to the It is in the field of excuvation and research that the most noteworthy activity may be recorded. The new regulations

may appear to be severe and meticulous, but in practice they are found to be a real safeguard against unscientific treasurehunting, and while protecting the just rights of the national museum, they pro-vide efficient help and encouragement to properly conducted expeditions working on behalf of societies whose academic and

scientific status is unquestioned.

Our map shows the sites already being excuvated, and those where work is pro-



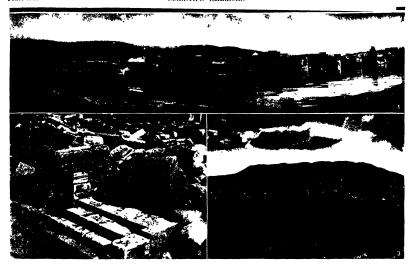
philip the polute at which exceptions are capted forward Sketch map of Palestine today, shi

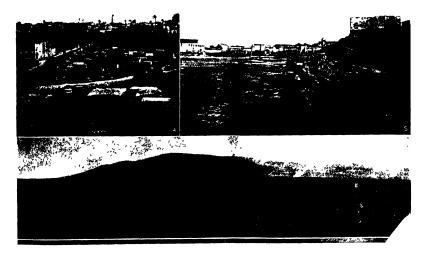
word Armagedon. Selection new measurement letters the University of Chicago, at the inates to Battarden, the narrow and work. At the inates to Battarden, the narrow and the selection of Selecti is here that the British School proposes to commence investigations this year Samaria, crowning a bill in the heart of the hill country, has already been partly excavated, and in true scientific fashion. excurated, and in true accomme manion, by the University of Harvard, under the leadership of Dr. Reisner, the same body has applied for a new concession. The Palestine Exploration Fund has

boun engaged these two years on an ex-Philistine city, and this year that pioneer hody will expand the area of its work and investigations to other Philistine sites in the vicinity, even as far as Gam and southward, in order to obtain a proper and fuller interpretation from the his

and their interpretation from the in-torian's point of view of the very im-portant evidence aircedy recovered. We may conclude this catalog of the present sites of excavation by reference to two upon the shores of Lake Tiberias (the fine of Galilee) the interest of which true ross of Gainee) the interest of which is more local and the work saif-contained. Just south of the modern town of Therisas the young Palestine Jewish Exploration Society has examined the ground border-

the young Palestine Jewish Exploration for the protect of the period of the Palestine Jewish Exploration of the period of the Yahund in trees of the period of the Yahund in trees of professing on the lake, recovering evidences of professing cross of the period of the Yahund in trees of professing crossly like in a well-defined manner the decoration of the seven-fold consideration. To most visitors to Palestine the work which has been proceeding for energy same the head of the lake of Thill Hun. To think the proceeding for energy same the head of the lake of Thill Hun. Latin "Outroft of the Hoty Latin" (and on the latin of the lake of the lake of Thill Hun. Latin "Canodiott (its deconded from the Crussdam), that which sippuls as of general interest and chares, alike from its character to the same and surrounding. For this to the other consumers, the same of the same and surrounding for the same of the same and surrounding for the same of the same of





Sawing Stones With Man-Made Stones

How Abrasives are Employed in Cutting and Shaping Marble and Granite for Building Purposes

By J. F. Springer



KCESSIVE hardness is so often associated with fragility that the use of the diamond in cutting marble and granite seems more or less unusual. Similarly, carborundum,

or less musual. Similarly, carborundum, ilundum, aloxite, etc. appear secreely suitable when applied to the cutting and fashioning of stone let, one or more of the artificial abreatve materials have already gone into such service

mercial use. Big circular saws have inserted teeth of carborundum, saws that are used in the cutting of marble slabs and the like. are in use where big gran-are in use where big gran-ite columns receive their flutes by the employment of similar means. Marble balusters are cut with ac-curacy and dispatch from rectangular blocks, carborundum being the active agent. Glass itself is very hard, but it yields to the modern abrasives. In fact, the cut glass industry is the cut glass industry is just about dependent upon abrustve wheels for the production of its designs. Most uses of abrustwes call for high speeds. The particles of hard and an-gular materials are not rigidly held on the periph-

rightly hald on the periph. The cut is seened taseth any in active yor of the may. The cut is seened largely by the vector of the may work the seened largely by the vector of the cut is seened to the cut it is among, but not quite, as if the lits of abrasity were little projecties. However, a projectic depends solely upon its own momentum, whereas the abrasite particle depends partly upon the backing of the nutrit is aimly it is seet, as well as packing of the matrix in warn it is see, as well is upon the momentum possessed by it. Since the weight is quite insignificant, this momentum is due ingredy to the velocity. Consequently, in order that a small par-ticle, held more or less loosely, shall really have a sub-stantial momentum, a considerable linear speed is

The standard linear speeds run, say, from 5000 to 10,000 feet per minute. This means that the particles of abrusive meet the work at velocities roughly esti

of abrustive meet the work at welocities rungibly cell matted at from one to two miles per minute. A little reflection will perhaps smifere to show that such speeds require either a bail, on a large district effect of the control o

eter as small as 20 inches or as large as 28 linches, or more. The linear speed at the periphery is properly 7000 fort per minute. This can be produced at the very reduced the peripher of the peripher of the peripher for the peripher of the peripher of 245 feet, the pan required will only be 201. However, the peripher of the peripher of 245 feet, the pan required will only be 301. However, the peripher of the p

friture. The business part of the insertic testh is of a very plan size part of the insertic testh is of a very plan size part of the part



Inserted tooth saw in action. The peripheral speed in 5000-10,000 feet per minute

the in the seconds. With the seconds is the seconds with the seconds with the second s to all conditions. No plastering is said to be required even when entiting fine moldings, fitted columns, etc. The teech may be removed and re-inserted at will. The saws require but little mechanism for their successful operation. Machines built for using an abrasive wheel conjusting of a steel central disk and an outer ring of an abra-

of a steel central disks and a matter from of an abectairw set in a suitable mate. On work in central disk and
airw set in a suitable mate. On work in central disk of
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jecting portions and list. They come in two or three sizes. A steel dide to dimensioned that with the testing the state of the state of

be rotating at about 567
r.p.m With 25 large teath
round its circumference,
18,925 teath will pass a
given point per minute
With the 40 small teeth,
we should have, under the
same conditions, 22,230
teeth passing per minute.
In this latter case, 871
feath will give desired. teeth will fly by during

each second,

If we know the speed with which the work advances, we may readily calculate the number of teeth which operate on the stone per linear inch of advance. per linear inch of advance.
Such saws as I have been
describing are adapted to
cut work from 4 to 85
inches thick. Suppose the
work is eight inches thick
and that the saw eats ahead
at the rate of 12 inches per
minute. This would be one
held for seconds. With inch in five seconds. With 871 teeth passing per sec-

made in considerable quantities by means of earl undum wheels. In this process there are two neght of procedure. In the one, a machine nanheques to ordinary turning fathe is employed. The rectange block of stone is properly set between centers or is lathe and then rotated at stone 100 rp.m.gr.A. big m ordinary travitage lather is supplyed. The resteaquest book of often is properly see between centrers or this laths and then rotated at about 100 paging. It is contained to the centre of the centre

cated form. But these op-erations may also be done with the abrasive wheel subsequently to the moid ing operation. That is, an abrasive wheel two or three inches thick is mounted on the sphalle which accom-modates the moiding wheel. It is then were as high modates the medding wheel, It is then run at a high rate of speed and made to cut into the molded het not quite finished believer, while the letter slowly relative. The haluster may in this why be cut to the proper length. The square length on the planer, The block, not perfectly on the planer, The block, near man'ry a finished het.



work is first beneath it on the plates. Where a good deal of effice has to be removed, it is possible to use a cover got whose the a rectiment years for the date cover got when the a rectiment years and the date said if does the roughing work and is followed by a suching when made from a fine got in the country was a rectiment of the count

shapes. A notable advance made in recent years concerns the certifing of president of the property of the certification of president and the certification of the certification o developed for the express purpose of desting with the retractory since. One advantage of using a principal wheel is that the wheel cents freely—that is, without proposing appreciable resistance to the work This is radically different from the way in which an ordinary lashs tool cuts nearly from the way in which an ordinary lashs tool cuts nearly from the work a wife, almost unjoining resistance. The advantage of a free-cutting wheel operating in the fact that such action next yeal eliminates breaking or damaging the stone. In con-

or damaging the stone. In con-nection with fluting, the abraheel is run along the sides of the location where the finte is to be and so cuts two long Coping a pair of granite columns prepar atory to futing. The machine does no siots. The material in between slots is then pinched out, and

slots is then plached out, and story to manage. It is stone cutter doos the remainder of the forming by hand. This work of slotting for flutes is done on the planer, the wheel being set up at the head and the work being rat under it on the plates of the unschine Jointing of givants columns is done out the thin, owners made of the abrasive True Joints are readily wheels made of the abrasive True Joints are readily

Johnton of greates evolutions in code which are readily when made the provided from the format when the provided from the format when the contract of the cont

Kinin is the pressure due to a need of 183 rest. The accompaning illustrations show the various kinds of machinery employed in cutting and shaping stone, and also the inserted tooth stone saw with the abrestive teeth placed in dove-tail slots.

The Physical Basis of Life Long ago it became perfectly Leplain that what we call protospans in not chemically a ringle homogeneous substance. It is a mixture of many substances, a mixture in high degree complex, the seat of varied and incessant chemical transformations, but one which somehow holds that to its own specific true for counties green. cific type for countless genera-tions. The swidence from every source demonstrates that the source descourrates that the optil is complet organism, a riferences, a living system. With the increases we destroy the complete of the compl and central pooles, and many kinds of grantles and fibrilia. Some of them seem to be per-mation; that come and gas in the insledescopic operations of cell-life. Which of them are alive? Which, if any, consti-tute the physical basis of life? What, in other words, is prote Diamen?

plasm?
These are embarrassing quos-tions. The truth is that the more critically we study them the more evident does it be-come that we cannot single out.

come that we canous negatives any one particular compenent of the cell as the living stuff, par excellence. Of this fact most experienced cytologists, including such eminent lenders as Flemming, Strasburger, Bilizchil, Kolliker and Heidemhini, long since became convinced "No man," says Flemming, "can deather are with pritoplasm as "andmide as within pritoplasm."

"No man," says Flemming, "can definitely say what protoplasm is In my view that which lives is the entire body of the cell" It is this view of the physical hadis of life that has physical haffs of me that has impressed as more and more as our knowledge of the ceil has advanced, and this is as true of the physiologist and the chemist as of the cytologist. "We canas of the cytologist. "We can-not," says Professor Hopkins, a distinguished blochemist, "without gross misuse of terms, speak of the cell life as being ussoci of the cell life as being associ ated with any particular type of molecule. Its life is the expres-aion of a particular dynamic equilibrium which obtains in a

polyphasic system Certain of the phases may be separated, but life is a property of the cell as a whole, because it depends upon the equilibrium displayed by the totality of co-existing planes." This conclusion is

the totality of co-existing planess." This conclusion in substance precisely the same as that of the cytologist When we speak of protoplasm as the physical basis of life, therefore, we mean almply the sum total of all the substances that play

any active part in the cell life, and we cannot exclude from the list such substances as water and inorganic saits which we commonly think of as "lifeless," A first sight this may seem a rather barren conclusion, but the fact is quite otherwise. No concep-tion of modern biology offers greater promise of future progwhole is a colloidal system, and that what we call life is, in the words of Czapek, a complex

of innumerable chemical reactions in the substance of this system Modern investigation has indeed already this system much by the point of view thus offered as to suggest that the study of protoplasm and the cell may be destined to pass more and more into the hands of the physiologist, the physicist

and the chemist In any case, the rising tide of cell research the rising tide of cell research in these directions is of good augury for the future experi-mental sanalysis of vital pho-nomena. There are, however, other aspects of the problem whith still escape the precise quantitative methods of the physicist and chemist, or are only beginning to come within their range, but which are none the less amental to our view of the general problem. I refer to those phononem with which cytologist, the embryologist and the geneticist must try to deal -Abstract from first Hedg-toick Memorial Lecture by Profeator B B Wilson, delivered in Roston December 20, 1921

Pure Ozone PRIFESSOR E. H. RIESEN-PRID, of Berlin, has re-cently described, in the Chemi-ber Estima for October 7, the preparation and properties of



pure onone. Osonized oxygen containing 10-15 per cent of oxone was liquefied in exhausted glass builts by cooling in liquid air The deep blue liquid, on exposure to reduced pressure, gave off mainly oxygen, and at n certain composition separate into two layers, the upper, dark hine, layer was a solution of osone in liquid oxygen, the lower, deep violet-black, layer was a solution of oxygen in

balaster concerning the control of t be expected from the endotherinic character of the substance. The critical temperature is 5 degrees Centi-grade, ho evidence whatever of the existence of higher loylumer of oxygem was obtained, both in the liquid and gaseous states the formula is O. This work is of great intervol, and, apart from the determination of the physical properties of ozone, it removes the last doubt as to the simple character of ozone-"oxonon"

Water-Power Plants in the United States THE United States Geological Survey, in a recently published compilation of data regarding the devel-oped water power in this country, shows that at present oped water power in this country, shown that at present there are 3116 water power plants of 100 horsepower or more, with a total capacity of installed water wheels of 7,952,948 horsepower Of this total 70 per cent is in public utility plants and 21 per cent in manufacturing plants. It is of interest to note that the census of 1908, which cubraced plants of all sizes, in-

citided ten times as many plants as the pres-ent report, which embraces only plants of

100 horsepower or more New York still maintains its New York still maintains its position as the leading State in the amount of developed water-power, with 1,291,857 horsepower, California is a close second, with 1,46,000 horsepower, Washington is third, with 454,856 horsepower, Maine closely follows in fourth place, with 449,614 horse-power, and Montana is fifth, with 344,420 horsepower

To permit a comparison of the developed water-power with the surces a table is included showing num and minimum potential water po

the maximum and the United States. The potential water power of the United States was determined by dividing the rivers into sections of different lengths, the length depending on the stope of the channel, and the fall and flow of each section were determined from the best information available. With these factors the potential water power of each stream was determined on the assumption of an efficiency of er cent in the water wheels

C 233

total water-nower res

Forming a balustrade

75 per cent in the water wheels. The minimum potential water-power is based on the average flow of the two seven-day periods of lowest flow in each year of record. This, of course, does not give the absolute minimum flow, but for all practical private institute minimum now, out for an practical purposes potential water power based on the flow may be considered as continuous power. The maximum potential water-power is based on the flow available for 50 per cent of the time

on per cent of the time.

It is the general practice in the construction of water-power plants to install hydraulic machinery capable of utilizing stream flow far in excess of the absolute minimum and much in excess of the flow used in determining the minimum potential water-power as given in the table. This practice is forcibly brought out by in the table. This practice is forceibly brought out by comparing the minimum potential water-power with the total capacity of water whosh installed in water-power with the comparing the comparing the comparing the water-power of the United States were to be similarly developed, it would probably be necessary to install plants having three or from times the capacity of the estimated minimum potential water-power as given in of the table—Authority from article in develope for Josuary 12, 1928



The Airplane-Carrier "Langley"

While the United States ship "Langley bey joined the battle field of the bey long the ship "Langley bey long the ship the ship "Langley bey long the ship with a new same and an attempt the ship with a new same and an attempt to the ship with a new same and an attempt to the ship with collection of some time to the ship with the ship with the ship with the ship with which will be ship with which will be ship with the ship with which will be ship

thirty or more triu and dataty airplanes. In changing the ship over from collier to carrier, a clean sweep was made of all the structures above the upper deck, to make way for a broad, lofty and unob-etracted thing deck (flose are the tail usants and the long line of derricks for handling the cost. Given also are the subde stacks, and if someone who had

swike stacks, and if someone who had never least of a siphane carriers, were suddenly to come upon the ship, she would took as though some stant carriers that are his plane over her superstructure and then his plane over her superstructure and the his state of the state of the

the "Jupiter," she was put into commission, this ship

輾

The main dock of the Langley, showing on each side the latticed steel columns which carry the flying dock above

signaling radio musts which can be housed vertically below decks. To conduct the furnace gases away from the ship, two horizontal smote docts are provided, which are inter-connected so that the smoke can be discharged on the less side of the vesses.

The large cargo space of the ship is available for storage of similanes, spare parts, and the various equip-ment required by an airplane-carrier. There are maga-

refers when "the glassis' size lyings off, or fring on.
Very instruction is the 'onitivity plotters, and the control of the co



The spinsh of a salve of 14-inch shells fired by the "Mississippi" against the "lowa" (left). Ship in the fureground is observing the full of the shells

carried a new type of motive power, the electric drive, which was destined to be so successful as to cause it to be adopted as the drive for all capital ships of our to oe acoptest as in the trive for an emptial silips of our navy A sister-ship the "Neytune," built at the same time, was equipped with a mechanical gear drive, and the "Jupiter" showed such superior performance that, so far as the turbines and gears built into the "Neptune" were concerned, there was no question of the superior economy and all-around performance abowed by the "Turbine". by the "Jupiter"

by the "lighter"

The "Langue" is 562 feet long over all, with a beam of 65 feet and a mean draft of about 28 feet lengther and electric motors operate two crows and her speed on trial was 15 mots. Her original normal displacement was about 3,000 tone. She was immanded in 1912, and converted to no nirplane-carrier 1850/1621 above the main deck out outries, the extractionable were removed and above the main deck outries, the service were removed and above the fine and one of the ship, was exceed a series of ionly lattice atted columns, the service of the ship, was exceed a series of ionly lattice atted columns.

verse girders running across the width of the ship to carry the flying deck. The whole flying dock. The whole series of columns was strongly braced, both transversely and longitudinally, and upon them was built a flying deck fife test long with mothing projecting above its surface except two sines for the ammunition of the guns carried by the ship and for the hombs to be dropped by the sirphshes. The gasoline tanks have a capacity of nearly 600 tons,

The passiline tanks have a capacity of menty 500 tents, and there was used make for the Arga amount of British by an elaborate pumping plant, which leads to the hangars and to the figing deck.

The carpo holds have been silvered to as to give the Theorem of the state of the sta

meaplanes.

The illustration at the top of this page is taken so the main assembly deck below the flying deck. On she's side will be noticed the lattice columns which warry' the flying deck above. Attached to the girders which spiper.

Fitting on the "form" took place on two days. On the dirst day the "Municippe" fived her dre-sich, the calibre gam single this welled, high explosive projection. This firting took place at from 18,000 yeards of the 5000 yeards. Later that some day the "Riminsingse" and the work of the state of the sound of the state of the sound stay the "Riminsings" areas of 18,000 yeards where at an initial some of the workshop years, which we decremed destruct a sent Parkinsingse" and state of the sound that the state of the sound that the state of the sound day, the "Riminsingse" again since typic for "form" at two 18,000 to 18,000 years with the Single gap side, the lithewalf of delile. Later that day, the man are sound to sent the sound in second war, and elementary the flag them to the sound in second war, and elementary the flag them.



Inventions New and Interesting

A Department Devoted to Pioneer Work in the Vanous Arts and to Patent News



A voltmeter and ammeter for locating automobile troubles

A Combination Voltmeter and Ammeter

A Combination Voltmeter and Dr nearest administer voltmeter and the combination voltmeter and a managed the continuation voltmeter and a managed the combination of the section of the sec

positive side of the electrical circuit is commonled.
The small bettom in the face of the interviewel; is used for earling the usedle exactly on new. In suthing the voil interviewel; is seed in the control of the con



the cubies at the top of the instrument and disconnects it from the voltmeter prods at the other and As many as 30 distinct tests may be made with this

Radiant Heat and Steam for the Complexion A MASK which contains an electric

Alight for the administration of radiant heat to the face and has a n radiant beat to the face and has a nection with a section property of the desired product of a New York numberature whose colon is that this combant in product of a New York numberature whose colon is that this combant in York make in made of aluminum. It sarvabpes the face, which receives it will be a new first that the radiant heat from a 60-watt law predicts that from the polithed metal interference which is the same time stems is empirical from a generator which is expected from a generator which is not considered.

heated electrically from any lamps observed the diseases it is claimed, can be traced directly to the clogging of tip-prose which prevents the blood impurities from being expelled in the natural time of the control o



Steam-heating the complexion

A Clock. That Never Peggets
ANY people have trouble in wasen
Marky people have trouble in wasen
Marky people have trouble in wasen
Marky and the people of t A Clock That Never Forgets

to purchase butter for tomorrow a break fast for the clock will have gived their c nectosusems before it is too late. This clock will have gived their c nectosusems before it is too late. This clock will have been considered by the control of the inside the mechanism and sets off the

A Motor-Generator Charging Set for Radio and Automobile Batteries

AGOOD many people own radios a
A large number own motor cars and
jules a few own both Here is a charg
ing set for the sturting butteries of the
car or for the A butteries of the radio
both at which have the good fortune it
require the same voltage. The motor



Charge your own batteries from elec-tric light circuit

part of this set which is the product of a Ceveland electrical manufacturer inkes the regular 150-out pressure rates the regular 150-out pressure it will set the majority of electric light circuits in the U S A The little D O generation gives current at a lin 10 witer, marked the control of part of this set which is the product of

Steel versus Rubber

A PORTURE awaits the maker of a vehicle wheel which has such high merit that it will supplant the rubber tired type now so almost universally in use. It is true that wheels enough to make a huge sutomodif. of the Patent Office at Washington have been invented. make a huse automobils, of the Petent Office at Washington have been invested to Office at Washington have been invested that represented the rubber tire, either representation or solid rolls analysistestly on Many of these wheels supply spring electrons for pulses but it has remained Callf. In use springs in the rim not a rare flatture either but in this case they are used in a truly unique man recigin normal to the road surface but parallel to it. The wheel varieties for a rim and the recigin normal to the road surface but parallel to it. The wheel varieties fasted data thou whome periphery are let fast axes as he'r re mentioned parallel to the road surface. These springs are gloos let into the inside of a rim having fichanised erose-section. As the win does could feater a recommendation of the recipies of the recipies of the recipies of the surface of the surface. These springs it is claimed that the one of sign does away with much vibration as these safety and the safety as a rubber single will last longer



This instrument does many things

Electrical Etching, Demagnaturing and Annealing
A Velectrical Instrument which could be seen in the country of the seen in the seen it as an either in the marking of shop to attach the pencil cord to the co to arraca the pincil cora to the connection on the instrument and write with the crilinars touch on the tool. In addition to this the instrument may be used for light annealing and soldering point is used in place of the exchange point is used in place of the eccung pencil and the work to be annealed is held down to the surface plate mag netically. In soldering the instrument is used in the same munner as for an nealing After the carbon point has been applied the sider is flowed on in the usual way. The total weight is 20



Still another spring wheel



Directing traffic with the winking

pounds, so that it may easily be carried about a shop to any place where it is needed.

Stabilising Carburetor Air COMPLYTE combustion of the fuel of an internal combustion engine depends upon the use of a correct amount of oxygen as proportioned to certoen and are (asoline as a fairly stable element of the mixture, but air, furnishing the excession oxygen, is in constant variationally as the combustion of the mixture, but air, furnishing the excession oxygen, is in constant variationally and the combustion of the combustion of the mixture and the combustion of tically uniform content and delivery of oxygen it disturbs these otherwise pro-portioned fuel elements, resulting in incomplete combustion with loss of power and waste of gas. Air contains oxygen in direct relation to its density At high temperatures it rarefles and At high temperatures it rarenes and carries less oxygen to the cubic foot, but if its density is decreased by artificial saturation, its temperature lowers ac-cordingly and its fuel value is restored and uniformly maintained. Such artiand uniformly mantaned. After are ficial air saturation is accomplished, according to the claims of its Niagara Falls makers, by a device for that purpose, called an air stabiliser. As shown in the Illustration, this appliance takes the air through six humbdifying or asturating



A new attack on the miles-per-gallen problem

screens which are kept moistened by a flow of water which is questionly drawn up from a basin by capillary astraws up from a cosm by caputary ac-tion. This saturation increases the des-sity of the atmosphere, reduces its insu-perature, and restores its percentage of oxygen, delivering to the carburetor a supply of properly conditioned air fuel-large avings in fuel consumption are

The Flashing Gloved Hand A GLOVE having attached to its back A a pair of small electric bulbs, one A h a pair of minal electric pulse, one-red, one white, connected to a dry cell carried in a pouch on the gauntlet of the glove is the clewer investica of an Eng-lishman, for the use of traffic policeons Contacts are made by closing the finger next the color of bulb wanted. The signext the color of bulb wanted. The aig-nul is eminently practical because it be-comes virtually a part of the policeman, and is so quickly and easily manipu-lated that it finds constant use. There is very little about it to get out of orde or, like many devices employing electric lights in connection with the human form, to get in the way or be too heavy

A Return to the Steam Motor Car

Motor Care
THE inventor of a new type of seam
I belier for the automobile sees the use
of gasoline for the self-propelled whicle
as only a temporary phase in the course
of its development, while the sterm propolled car, because of its comparative
distributions, is destitled situation of
"come back." One of the chief frombes
that beset the steam automobile boiler, especially in the hands of operators who
are not aiready steam engineers, was
caused by an accumulation of night frosh
fairly insolutes the water from the fire,
permitting the part of the boiler which



This steam meter-car beiler cannot

is not covered with water to reach
a lighter temperature than the ordinarily
limiting temperature of the bolling point
of water under pressure and leading
of water under pressure and leading
whiter il Kverick of Los Angules, the
luvening of a boiler made to forestail
such results, states that the vertical
tubes of the new boiler are all welded
tube and the state of the the bottom
Owing to the fact that this is below ine
excumulation of sections it cannot born
excumulation of sections it cannot born seven of the nre, when it gathers an accumulation of sediment it cannot burn out. The same principle is equally as applicable to the locomotive boiler. It is stated that this new boiler has been given hard service during two years and has stood up in a remarkable manner, owing to its careful design.

Improving Radio Broadcasting A 8 yet no method has been found for phone transmitter or microphone all of the overtone components of the human voice and of certain orchestral instru-

so rich in overtones. Mumerous tempfs have been made and the re of these represents a street tempts have been made and the record of these represents a steady svelution toward the desired goal of perfection. The chief trouble with the metal dis-phragm has been that it has too much inertia and too little fieribility to follow the rapid vibrations made by certain of

the rapid viocations makes by ceram of this plays (viocations makes by ceram of this page is the product of research by Prillips Thomas of the Westinghouse Effective and Mannfacturing Company. Its distinguishing characteristic is its at low pressure, which provides a means at low pressure, which provides a means of fonisation conduction is open air. The application of a moderately high direct potential between two electrodes separated a short distance in air, with most of the provides allocation of the provides allocation provides allocation of the provides allocation provides allocation of the provides a



A road form that stays put in line

to one will give loud signals in a head-set Draft shields are used to exclude disturbing air currents. Locating Defective Wires

A VERY simple, though ingenious, method of locating either grounded circuits or broken wires in underground circuits or broken wires in underground or conceasied condusts has been deprised by Seese 3b. Debrick, nestatent forement of signate on the Pennsylvanis Baltroad two iron rods about the size of walking actics which are connected to the two leads from a telephone receiver An atternating current or a pulsating direct interaction of the property of the position of the property of th this means and a current will flow Intesting, the operator walks skug the line and throats his two rods into the sarth at points about a yard spart. As long at points about a point about to the point in the power line a noise will be pound in the power line a noise will be pound in the beisphore receiver The tests are continued until the sounds cosms. This indicates that the point of treviable has been passed for no current is now being picked up by the skephone are well as the point of treviable has been passed for no current is now being picked up by the skephone are well as the point of treviable has been picked up by the skephone as well as the point of treviable has been picked up by the skephone as well as the point of treviable has been picked up by the skephone as well as the picked picked up the skephone as well as the picked up the skephone as well as the picked up to the skephone as the picked up to the skephone as the picked up to t these having passed beyond the return earth circuit. In a similar manner an earm circuit. In a similar manner an open circuit may be tested, owing to the fact that there is a condenser action between the wire and the earth which sets up a flow of current through the

A Distinctive Read Forms; DOAD forms he making concepts to content the making concepts to these is often some amorpance concesses with the method of looking the sections together firstly, as well as in the unlocking after the concepts had set.



A displacagation microphone for radio

hevesdessing

A. Giveshad mannifecture has put on
the market a form having a unique
tocking device designed to facilitate
quick locking and unlocking. This consists of few very simple wedges so desists of few very simple wedges so defacent format to get out of line on either
test not on face. The lower wedge
resembles a resulting frog such as that
the total control of the control of the
test on described railway review in the
table to correct position with regard to
table the correct position with regard to
table the correct position with regard
to the lower, no matter how cateshoatly they
are brought together by the workman.
The practically salfestinging and hock-proof,
and facilitates the later process of edging. The sections are 12 feet in length
and the control of the control of the
feet in the control of the control
of the control of the control
of the control of the control
of the control of the form interes an
ing mechanical finishing and subgradien





This new machine grinds round holes

A New Internal Grinding Machine

NEW YORK maker of machine tools A NEW YORK maker of machine tools has placed on the market a new grinding machine, the invention of Fred E. Bright, which embodies a new fundamental feature in the form of a revolving and reciprocating work-carrying spindle in one bearing, eliminating the necessity for its exact alinement with necessity for its exact aumenican with other essential parts of the machine This makes possible great accuracy in the finishing of straight round holes. The machine is intended primarily for manufacturing operations and grinds cylindrical holes only.

The grinding wheel spindle is direct driven by means of an inclosed silent.

The grinding wheel spindle is direct driven by mean of an inclosed silent chain from a 1½ horsepower induction manufacturing accurately the wheel speed Owing to the vertical position of the spindle, floor space is conserved and the use of motor drive disminates bells and chine has an automatic floot, but can be fed foreward in units of one ten-thou-manth of an inch. Provision is used for dressing the shockar's wheel by lower-costs an old-ank, with a pump for cir-cults and a spindle of the spindle of the costs an old-ank, with a pump for circeals an oil-tank, with a pump for cir-culating the inbricant.

Roller Bearings for Railway Cars A LTHOUGH the roller bearing itself is not by any means new, its application to the immense amount of railway relling stock in this country has



awaited the perfection of a hearing that would stand up to the extremely heavy duty required for such work, and he as eafs and as free from the necessity of neating frequent repairs as the ordinary type of plain hearing. Such a hearing as is aboven here is applicable to use on flywheel shafts, heavy holating machin-ery and other stuniar work, but in greatest potential use is for the axies of rail way cars. Experiments are now bein ich are rather in the nature o made which are rather in the nature of tests of a type of self-contined, self-alining roller bearing for regular dulty railway operation on one of our most prominent railroads. The bearing has held up in satisfactory condition after eightren months of zuch service Or dinarily this would constitute a fairly conclusive test, but for railroad service settembly conservative criteria are nec-cettembly conservative criteria are necextremely conservative criteria are necessary. Given practical roller bearings on our railway rolling stock, bearings that have long since passed the experimental stage and which have demonstrated their shilly to take hard punishment, the saving in fuel and efficiency, not to speak of cost of freight movement, will be seconmons.

This unique bearing, which is made

This unique bearing, which is made by a New York manufacture, is self-aliming by reason of its outer race, which is ground spherical on its limer surface. The rollers are harrel-shaped, with their largest diameter toward the inner ends. This permits of great free-dom of movement between the hance and outer rings, which are always concentric on their bearing surfaces.

Lights Without Matches

A MINER who finds himself far from the shaft at the end of a drift without matches is almost as good as dead If his carbide miner's light has an auto-matic spark light its extinction is of no nce a quick motion of the



An acetylene headlight with self-

hand, a spark is alsot across the issuing acctylence gas and there is light. This is brought about by means of a flut and scraper. Such a light as this, which is made in Chicago, should be as vituable to night hunters, woodmen, campers and furneers as to missees, because no matter how wer or windy the night the film martly intended to be wore on the hat where it is always directed on the thint where it is always directed on the thint that claims the wearer's attention, but that claims the wearer's attention, but it may also be carried in the hand or worn on the front of the cont.

A Trackwalker's Kit Truck

together too heavy for one man to carry together too heavy for one man to carry From Germany comes a solution of the matter in the form of a small truck such as is used by section gamps on our own reliverys for moving tics over short distances. Mounted on this truck is a large toolbox centaining a collection of reliverys to the collection of a such as a masorf-relivery of the collection of the collection of the collection of the collection of the such as the collection of the such collection of the collection of the collection of the such collection of the collection of the collection of the such collection of the collection of the collection of the such collection of the collection of the collection of the such collection of the collection of the collection of the such collection of the collection of the collection of the such collection of the collection of the collection of the such collection of the collection of the collection of the such collection of the collection of the collection of the collection of the such collection of the collection of the collection of the collection of the such collection of the collection of the collection of the such collection of the collection of the collection of the collection of the such collection of the collectio plates and spikes. This avoids the neces-sity of keeping these articless distributed more or less eventy giong the right of way, as in now done in this country, in order that when needed by the track waiter he is fairly sure of finding the desired replacement within a hundred yards of the job. These parts, when thus aprinkled along the track, are almuns springed mong the track, are al-wans subject to petty theft, as well as providing amountition for boys with throwing propensities. When contained in the track truck they weigh one or two in the track truck they weign one or two hundred pounds, but such a lead may be pushed along the truck by the track-walker with less effort than that re-quired for carrying the heavy maul and



Carries tools and spare parts for track repair

spanner On the approach of a train it it is only necessary to tip the tool truck completely over, employing for this pur-pose the long lever ordinarily used to push the truck. The train having passed, the process is quickly reversed and the the process is quickly review and the truck is again on the rails. It is pro-vided with props so that the track-walker may leave it standing when he stops to inspect or work

A De-bouncer for the Car

A SHOCK absorber must not deprive the springs of a motor car of their destred function of "letting the rider down easy." but they must prevent the annoying upbound which throws the rider into the air Therefore they must act only on the upward motion of the springs, letting go instantly when the car body atria down. This function is well provided for in a type of shock ab-sorbar called a "checker," made in Clove-land for a well-known type of car A land for a well-known type of car A rules acts, in this case, between the surving and stationary parts, wedging them together on the upthrow and have been considered to the survival and the sur

A Chemical Sponge for Refrigerators

A PIECE of charconi will absorb 3000 times its volume of gas and it is for this reason that charcoal is often taken for stomach trouble, Material having similar chemical properties is used to a New York manufacturer for filling by a New York manufacturer for filling a neat little chemical sponge for absorb-ing odors in the refrigerators, where milk and buffer will so quickly absorb them if the chemical sponge is not pro-vided. The article lasts about one sea-



son, but is inexpensive. Where the ice is impure it is impossible to keep the ice-box perfectly wholesome between clean-

ines, no matter how frequent

A Blueprint Dryer with Thermo-static Control EXPERIMENTS have proved that in

L order to pass wet hineprints through a dryer without wrinkling, it is neces-sary that the heut of the drying cylinder must be constant. This is a rather dif-ficult thing to accomplish in a perfect manner. Therefore the application of manner Therefore the application of a thermostatic control to a blueprint a thermostutic control to a program-machine by a Chicago manufacturer is a distinct sten in advance. The thermoadministrator in advance. The thermo-stat cannot forget. It might be said to "work if you fall asleep". It is sensi-tive to slight variations in temperature and catches them before they become so bad as to be harmful. The result is a blusprint of uniform texture and free-dom from wrinkles. The machine has a copper cylinder which it is claimed, will heat quicker retain the heat better, and to which the prints will not adhere but will peel off automatically. The apren is made of asbestos and will not rot out because of wetness, like canvas aprona-The drive gives two speeds ahead, four and eight feet per minute, respectively.



A shock shoother on a differ



This wastehanket attaches to your deak

Rull-bearings are used throughout, cutting operation costs and necessitating only a %-horsepower motor Gas or electricity may be used for heating.

Road Construction Turntable
Speeds Up Truckwork

N road building slos, owing to the
narrowness of the space between
the subgrades, it is generally nessessing
for trucks which have delivered a lead for trucks which have delivered a made of material to back up several hundred feet, or else to turn under their own power in the narrow space, which oper-ation usually damages the subgrade. In on, when trucks meet the confusion owing to the small space for maneuters. Therefore a turnitable for turning trucks, which is made in Pitts-burgh, meets a need. The turnitable ocburgh, meets a need. The turntable ocof the road. In turning, one end pro-pects over the road forms. This means that an outgoing truck has free way to pass the turntable at all times, and that the forms remain in place regardless of the operation of the turntable. It is mounted on a skid which enables it to be moved from place to place without tear-ing up the subgrade The turntable is attached to a returning empty truck and moved the required distance without

A truck, after being driven on the turntable, is secured from tipping by supports at either end of the table When the truck is ready to be turned a lever is operated which folds up these supports and then acts as a push bar by means of which one man can turn a 5-ton truck loaded with four vards of material The runways which support matrial the runwijs wine support the truck are mounted on a triular track of smaller diameter than the width of the truck. This track is placed imme-diately above a similar track rigidly secured to the skids. Between these tracks is a series of rollers so that there traces is a series of rollers so that are no axies to cause friction. A center pin rigidly secured to the skids which support the lower track holds a spider which keeps the rollers in place and also central bearing for keeping the upper track properly centered

Drying Negatives Without Clips PUTTING a large number of negative I into ordinary clips for the purpose of drying them takes time and often of drying them takes time and orien damages the negatives by scratching them It is much easier to plach them between the colls of a long spiral spring made in a Philadelphia manufacturer



for this purpose. These have room for a large number of negatives and their insertion requires only a movem the fingers in bending the spring.

A Waste Basket for Careless Marksmen

ONE of the most irritating habits of ONE of the most irritating habits or waveleaskers is to place themselves where they weren't, yesterday or the days before. The busy office worker without looking up, aims his waste paper where the basket ought to be and so the foor soon takes on the general appear-ment on paper mit. Weifford Mass, manufacturer has deviced a wavelebasket, which may neglectly be affactured to the which may quickly be attached to the end of a desk, or, if desired, underneath end of a deak, or, if desired, undermeath it Here it always stands—or rather, hange—and random shots at it hit the target because it is always there. The desired type shown in the illustration hangs from a small bracket attached to the under side of the desk top ledge. The under-deak type, which is not illustrated by the contracted hangs from a row of which has a The under-desk type, which is not illustrated, hangs from a rod which has a spring, causing it to thrust its respective ends, each of which hears a rubber tip, against the opposite sides of the space breath the desk. The baskets are made of metal and make desirable additions to the furnishing of bathrooms for clean multiplied to the furnishing of the furnish and soiled towels, of kitchens as catch all and of libraries as receptacles for

magazines and papers.

A Simple Seed Drift

FOR the average home garden a seed drill is often a luxury that seems hardly warranted by its small area, as hardly warranted by its small area, as well as an inconvenience owing to the two loop handles being in the way the the ends of the abort rows hear the two loop handles being in the way did not been a sealy done poorly, but is with difficulty done well. It is an excessive the same of the property of the sealy of the property has a successive to space the individual seeds somewhat uniformly and to drop them. is to see that no large gaps are left.

The gardener often begins the sowing
of a long row by hand with good inten-



A novel and practical seed-drill for the home gardener

tions of using care in order to forestall the troublesome thinning later on, but finishes with an impatient rush, for space

ing the seeds evenly is very tedious.

A simple hand seed drill which comes
to us in the form of a photograph from



A practical turntable which saves time for the contractor

A Practical Scissors Sharpener SHARPNING a pair of scissors con Sists in making a 60-degree cut across the edge of the blades, but it is very essential that the proper angle and no other be given Moreover, it is neces-sary that the same angle be given along



With this guide anyone can sharpen

the entire length of the blade. In order to enable the scissor bludes to be held at this angle, not only on one stroke of the sharpening but on every one, a Chi-cago manufacturer has put out a simple ittis decice consisting of a piece of the decice consisting of a piece of for the blade. This prevents the accidental ruining of the work, however carefully done without a ruinde, by a stroke at a greater angle with the according to the control of the control of the control of the within the control of the control of the within any flat wheatons the near hap-ping the control of the control of the the control of the co the sharpening but on every one, a Chiage man, and a man can use it as we

Germany and which is neither cumbe some nor expensive just fills the need of the small gardener in this respect it consists of two seed hoppers which are attached to a cross-bar in an ad-justable manner, permitting proper sep-aration of the rows in sowing such vege-tables us, for instance, lettuce which is grown in double rows closely spaced. In order to feed the seeds into the rows steadily and evenly a spindle passes through the throat of the hopper just above the shoe that runs along in the ground and distributes the seeds. This ground and distributes the seeds. This spindle, which is provided with the re-cesses necessary to contain and pass out the needs one by one, and which is ad-justable for various sized seeds, is extu-ared by a where truming on the ground To prevent it from slipping, it has a received to the received and the parameter of the received and the parameter of the section of the section angle in measure of a wing to

A Clinging Grip on the Steering Wheel

A BURBER grip for the steering wheel A of the motor car permits the driver to retain full control of the car with to retain full control of the car with little expanditure of energy, due to un-consciously gripping the wheel until the hands become tired and much. This is especially true when the driver in war-ing gloves, as the hands then slip very easily on the polished surriese of the easily on the polished surriese of the the wheel, divining security and posser-bling a new bicycle tire. It is made in Otherse.



A handy shaving combination

Lather: Rub-It-In

WHEN the barber lathers you he rubs it in with his singers, but when you shave yourself and want to rub the lather in there is nothing to it rub the lather in these is nothing to it but a mussy job—makes you me some such a rubbee'in as aboven in the pic-ment of the pick of the such as the such which you proceed to use it the regular manner. Then, by manipulating a little side in the hands, the breath is drawn into the shall, like a truth's seck, and of the breath cate a rubber seck, and of the breath cate a rubber got having domain of little sing which actuates the breath in to the locks in the desired position at other end.

A Non-Metallic Automobile Body

THERE recently has appeared a fabric a type of automobile body which uses a wooden frame and dispenses with metal panels altogether. A New York textile company has produced a water-proof teather cloth of a lustrous finish, which is applied over a wooden body which is applied over a wooden body framework dressed with a coarse wire fabric and the necessary padding to deaden rattles and squeaks, as well as to fill out curre lines, etc. It is claimed for this new type of body, which has for this new type of body, which has been shown at recent automobile shows, that the cust of the raw material is approximately one-half of that used in a metal body, that the time required in making a cust body is one-half of that required in metal construction; that the civil panels weight only case-half as much as metal panels and that the fisieh is as metal paness and that the musa is equal in smoothness, luster and bril-llancy to that of a metal body. It is also claimed that the leather cloth lasts longer as regards finish than the usual finish of a metal job.

Radiant Type of Gas Heater

Radiant Type of Gas Heater
'ThiAT' the radiant type of boare was
I first adapted to the use of gas is the
contention of a reader of the Engraviro
AMERICAN, who states that the first derelopment of or the states that the first derelopment of or the states and the first derelopment of the states are the states are
two or three pears before the war This
heater was equipped with gas bumners
which heated to a high temperature or
refrectory maintrial formed in the
space over each finane, and raised by the
fame to incandescence. However, their
manufacture was stopped by the war,
the factories being taken over for war
in use all over the country.



An only way to avoid their wrists

The Service of the Chemist

A Department Devoted to Progress and Achievement in the Field of Applied Chemistry Conducted by ISMAR GINSBERG, Chemical Engl

New Element, Hafnium, Discovered by English Chemist
A N English chemist has discovered a
new element, which has been given An ow sement, which has been given the name handline. The element was isolated from a black send, which came isolated from a black send, which came from New Zesland This sand contained a certain proportion of titanium dioxide, and when this constituent was removed from the annd and examined by itself, it was found to contain a refractory pasting. Further examination of a new element, closely related to the time of a new element, closely related to the time. The name hardnum, which is derived from the name of the city of tanium. The name hafnium, which is derived from the name of the city of Cupenhagen (hafnia), was given the new element. It is said that the black sand deposits in New Zeeland, from which the sample of sand was taken which was used in the experiments, is more than seven miles in length and of unknown depth, so that if the new metal, harbitum, depth, so that it he hew metal, namum, is found to have important commercial properties, it can be produced in bulk it may be of considerable value in the making of incandescent mantles, as may be inferred from its analogy to the metals affection in an along to the metals affection in and ittanium.

New Steel
The Baglish firm, Vickers, has proL dured a new steel, which has the
following composition 60 per cent nickel,
12 per cent of chromium, 2 per cent of
runngames, 05 per cent of curbon and
205 per cent of from chrome is not oxidizable, that is, it will not rust. It was tested under the most severe conditions and was found to withstand corrosion under a pressure of 1000 stand corrosion under a pressure of 1000 atmospheres and a temperature of 600 degrees Cantigrade, the duration of the test being 4000 hours.—Onemiker Zeitung, 1922, page 1169.

Process for Conserving Sandstone A N Interesting process for the conservation of sandstone, in which a silicate preparation was used, was described in the November 22 issue of the Proceedings of the Royal Academy in London

Industrial Products From Acetylene

Activiene
IN an address before a meeting of the
French society, Societé de ChizaIndustriels, Prof. A Guyet gave an interesting paper on the industrial synthemselves, and the society of the society
hyde can be converted into metaldahyde
and paraldahyde. The latter is an important liquid fous and should eventually
reach a stage of great commercial inportance beautines it can be produced
out that processes were being studied on
a sexual-stage scale to utilize the ethylete
out each other size that the stage of the
metal control of the stage of the stage of the
metalness when the stage of the stage of the
metal

Effect of High Pressures
D ECRET's experiments have been made
to findermine jear what effect exto findermine jear what effect exlia, prejection to 50,000 atmosphere for 18 prejection to 50,000 atmosphere for 18 prejection to 50,000 pounds
pre épitave litels. Under seach pressures
mes aires effecties to pass direction pounds not server
mes au ser effectie to pass direction pounds not server
mes aires effecties. Under seach pressure
mes aires effecties du passare
the financia fraide parties. Under a pressure
of 12 foldo étimospheres parvelles and rebte beinge herder than soft reted and

phosphorus becomes black, non-combustible and a good conductor of electricity. The new properties are stated o axist after the pressure is removed.—

Jour. Soc. Chem. Ind., 1923, page 30

Making Artificial Pearls and Precious Stones A CORDING to German Patent No.
A CORDING to German Patent No.
These of the pearl or stone is coated with
a suitable phosphorescent material, so
that color changes are produced when
the pearl or stone is taken into a dim light. For example stones treated with sine oxide containing radium exhibit a color similar to that of Guignet's green color similar to that of chigher's green in the case of glazed pearls, the phos-phorescent conting is protected by a transparent varnish against atmospheric effects, and the glaze, if it is liable to be attacked by the radium compound, is similarly protected

Utilizing Oat and Peanut Hulls

In the manufacture of oatmeal and of peanut butter and oil, a large quantity of out hulls and peanut bulls is tity of out hulls and peanut buils to obtained as by products. These by-products are generally used as filler for stock freed, burned as filler of stocket to go to super a frup can be obtained by hydro-lyzing these by-products with two per cent of multuric acid for two hours at a pressure of 15 pounds per aguare inch Afrec hydrolysis the acid was neutra-ised with milk of lines and the songer used with milk of lime and the sugar was removed by pressing and washing the insoluble residue. About 25.5 per cent of glucose was obtained from the out hulls by this method and about 70 per cent from the peanut hulls -- Jour Ind Eng Chem. February, 1928.

Drying Wood

ONE of the greatest difficulties in the wood industry lies in the drying of the seasoning process. Wood the wood, the seasoning process. Wood is difficult to dry because the small cellules deep in the wood remain alive for a long time and a living cell does not easily lose its water. It can only lose its water after it has been killed by the action of a gas or vapor Accorungy ireas wood was subjected to the action of the vapors of bensine in a succelare. The cellule was killed in this manner and under the action of hot air the drying of this wood then took place very rapidly—low Ind Eng Ohom., February, 1825.

Fertilizing Forest Land

I has been generally held that wooded land, land covered with forests, should not be fertilized for there would be no resulting increase in the growth of the trees. This has been shown to of the trees. This has been shown to be erroneous, as treatment of such land with fertilizers containing nitrogen, pot ash, phosphoric acid and lime has in-creased the growth of trees in many cases. A test, extending over a period of 14 years, was carried out at Owing, Sigmaringen, on the alopse of the Jura Mountains, where a stretch of land that Momntains, where a stretch of land that contained only a few pine trees and juni-per bushes, and which had been used for some time for passurage was divided that two parts, one of which was frested with nitrogenous fertilines and sown with Swedish clover Both parts were then planted with fire and divided into sections owns, of which were completely

and others partially fertilized while others were left unfertilized. Between 1906 and 1920 the average increase in the height of the trees in the sections treated with Thomas meal and kninite was 523 centimeters, in those treated with Thomas meal alone 513 centimeters, and in the untreated sections only 408 contimeters. Ground burnt time by itm if effected very little improvement in the growth Trees in the sections planted with clover showed a very conplanted with closer showed a very con-siderable increase in growth, especially in the first year, but the tests on the whole showed that equally good results may be obtained by the use of mixed fertilizers without a precious crop of leguminous plants — Jour Soo Uhem. Ind., Feb 2, 1923

Paper From Black Butt Pulp

THIS paip is made from a tree which is indigenous to Australia Considerable experimentation has been done with this pulp in order to determine whether in s pup in order to determine whether it is not possible to use it in the place of suifite pulp, which at the present time is imported into Australia. It was found that 65 per cent of black butt found that 65 per cent of black buttpulp, 25 per cent of imported suities
pulp and 10 per cent of imported suities
pulp and 10 per cent of waste paper
made a very good grade of cream col
ored leid paper. Black butt timber gives
a higher yield of pulp per cord than any
other wood used at the present time for
pulping purposes. Purthermore, the
treatment is comparatively low—The Woeld's Paner Trada Review. Doc :20.

X-Rays Used to Activate Catalysts

WillAT pipers to be a new use for cussed in the Selfschrift fuer Silvator 1022, pages 472-3. Platinum tax process of making silvator 1022, pages 472-3. Platinum tax process of making sufficience of the artist process of making sufficient each, are subjected to the artist of the rays. They are made more active soo that the production of the acid is increased to a uniterful degree A in a lung-rature of 400 degrees. Centification, for example the 141 to 859 are continued to 200 degrees. 946 to 959 per cent and at 260 degrees Centigrade from 35 to 51 per cent. The activation is not permanent but gradu ally disappears within 24 hours after the catalyst has been treated with the rays.

Erasing Inks

A N interesting account of inks and A their crasibility is given in the Anales ascc. quim Argentina, 10, 229-8, Chemical Abstracts 1923, 476. The only indelible inks are those containing car potnesium permanganate followed by sodium hyposulphite are much better ink sodium hyposulphite are much better ink eradicators than sedium hypothorite and oxalic acid, as are commonly used The former eradicator will work on ani-line inks which the latter sometimes does

New Wespons for Boil Weevil

Till fight against the cotton holl weeto the cotton crop each year the combat to exterminate the "billion dollar ban dit" as it is called, goes on uninterto exterminate the "billion dollar ban dit" as it is called, goes on uninter-ruptedly Recordty new weapons have been developed to assist in this perpetual battle. For one thing poison gases the

military weapon developed during the war, will be utilized for peaceful pur-poses in the warfare on the boll weevil Another suggestion was the use of X rays stored in chemical suits and aprays stored in (nomical salls and ap-plied by adhesive mixtures to the bolls and squares of the cotton plants to sterilize the eggs of the insects.—Oil, Paint and Drug Reporter, Feb. 26, 1923.

Motor Fuel From Vegetable Oils VIGETABLE oils can be converted vessily into gaseous and liquid by drocarbons by subjecting the former to catalytic processes. The gaseous prod-ucts are hydrogen, methane, etc. while the liquid products, after neutralisation and hydrogenution, form a mixture con-taining appreciable amounts of bensene toluene and meta xylene. This forms a good motor fuel with a very agreeable

Sugar Cane Alcohol, a Gasoline Substitute

A CCORDING to the Oil, Paint and Drug Reporter of March 26, 1923, sugar cane alcohol is used in South Africa as a substitute for gusoline. It is claimed to give more power than gasoline and to enable the engine to be started more easily. The engine will start quickly in cold weather

Self-Lubricating Gasoline

A (CORDING to the Engineering ing possiline has been developed in Callfornia which possesses certain advanthe motor car owner Ordinary libri-cating oil is treated with a chemical and then the treated material is added to the gasoline in the proportion of one gallon of the treated oil to 500 gallons of the gasoline. It is claimed that this product will increase the mileage obtained from a gallon of gasoline approximately. 25 per cent. The lubricant introduced in this manner, penetrates to every part of the gas engine cylinder and lubricates the upper parts of the same which are not touched by the oil, fed to the cylinder in the ordinary man-ner Friction is thus reduced to a minimum and due to the elimination of excessive heat and pre-ignition, no carbon is formed. It is claimed that the gasoline mixture develops perfect atomiza-

Crucible Steel in a Hearth Furnace

A HEARTH furnace, which is capable
A furning out a steel able to compete with high grade crucible steel, is
the invention of a Swiss engineer. This
furnace has been installed in a foundry in Germany A very high temperature is attained in the furnace by the joint action of heated fresh air and gas gen-erated in a producer. The gas is burnt most rapidly due to the hot air and the narrow flame coming from the white heat section of the producer. The whole contents of the furnace are poured out into a large ladle raised to a white heat. which enables any sample up to 15 tons in weight to be cast in the most compli in weight to be cast in the most compiler coded molds without any premature cooling. The tenucious and substantial steel castings obtained by the new process will in many cases be a good substitute. for bronze as well as complicated forge

The Heavens in July, 1923

Something About the Methods and the Results of the Einstein Verification

By Professor Henry Norris Russell, Ph. D

VE outstanding achievement of observavs. ourannoung acuse-ement or onservaman stratum; at the time these words are written, justly takes the furnmost place of the lack observation. This is, of course, the precise and conclusive confirmation of the lack Observators, party at the Australian expeditions by the observations of last September Full details were made public by of tangbell a few days ugo, at the meeting of the National Academy of Sciences, and some account may

National Academy of Sciences, and some account may reasonably be expected by our readers. We all know, by this time, how Einstein predicted from his theory of general relativity, that rays of light passing near any gravitating mass should be slightly curved. The calculated influence of the plants is too small to measure, but that of the sun is considerable A ray which grazes its surface should be deflected by

A ray which grows its surface should be defected by 176 inches one passing twee as far from the sun's center, by half this amount and so on—the distance where the surface of the surface from a region where the weather chances

from a region where the wentner chances are good, and actually get our photo-graphs, we find ourselves faced with a number of practical questions. In the first place, what are the normal positions of our stars in the beavers, from which the Einstein effect seems to shift which the Elastein effect seems to shift them? This we can answer by taking an other photograph of the region—or better a set of plates—at some other time of year when the stars can be seen at night and their light passes nowhere near the sun. We have then to compare an eclipse plate with the others, and to hunt for the

But this senin is not as simple as it looks, for our two pictures may not be on the same scale owing to changes in the the same scale owing to enanges in the length of the telescope, or in the focus of the lens, making the same group of stars look higger on one set of plates than on the other. Now the Einstein shift seems to displace the stars outwards, away from the sun. The two displacements, however are not alike, for the change in however are not nilke, for the change in the telescope increases all distances on our plate in the same proportion and therefore affects the outer stars most, while the Einstein shift is greatest for the stars nearest the sun. If we measure, on our plates, some stars that are close to the sun, and others at greater distances, we will then be able to disentingle the two effects-at the cost of some loss in

A worse difficulty arises from the refraction of light in our atmosphers, which shifts the apparent positions of the stars, some more than others, by amounts which vary with their altitudes above the horiz vary with their altitudes above the horizon. To reduce this trouble to a minimum, we must take our night plates at an hour when the stars occupy as nearly as practicable, the same apparent positions in the sky, compared with the sky and the meridian, as they did at the time of the eclipse. The small outstanding dif-ferences may then be calculated and allowed for

The Details of an Intricate Task

So far we have assumed our instruments to be perfect, and in exact adjustment, but like all human defect, and in exact adjustment, but like all human de-vices they still actually be imported: We cannot hope to make them absolutely free from errors: the best was to be a supported by the still be private as the still be all the still be a supported by the still be private as the still be case an error in the position of a given star on one plate will be the same in all curses, and will drop out of the difference between the collipse plates and the plate plate and the still be supported by the still be supported to an approximation clause, the scope citch plate belockers and the like—must be constructed, not merely with the ut-most accuracy, but with great rigidity and stubility so that when set up in different places and at different times, we can get all the adjustments to be in practimes, we can get all the adjustments to be in prac-ticulty the same state. Any minute outstanding errors - such for example as might artise if the plate were not exactly at right angles to the optical axis of the tele-scope—can be allowed for in the calculations, but on this account the calculations become rather intricate, and very laborious, though they can be made as ac-

The British expeditions to Brazil and West Africa in 1919 set out so soon after the armistice that it was impossible to secure apparatus which satisfied all these exacting requirements, and the plates which they obtamed, while proving beyond a doubt that rays of fight passing near the sun were deflected, and to about the extent predicted, showed also some small deviations, doubtless of instrumental origin, which have given rise to much discussion (more in the writers opinion, than

22 At \$\frac{1}{2}\times \text{ oclock} \times \text{ July 3} \times \text{ At \$\frac{1}{2}\times \text{ oclock} \times \text{ July 3} \times \text{ At \$\frac{1}{2}\times \text{ oclock} \times \text{ July 4} \times \text{ At \$\frac{1}{2}\times \text{ oclock} \text{ oclock} \text{ oclock} \text{ Aug \$\frac{1}{2}\times \text{ oclock} \t At 11 o clock: July 7 At 10% o clock July 14 At 10 o'clock: July 22

was justified by the circumstances of the case.) was justified by the circumstances of the case.)
The Lick Observatory expedition, with ample time
for preparation and under the master hand of the vereran observer Campbell, secured equipment which
answered to the most exacting tests The leanes were answered to the most exacting tests. The lenness were specially designed to give sharp images over a wide field, the mounting was all of metal, and combined the necessary lightness with great rigidity, the instruments were pointed directly at the sun, avoiding the troubles

accessory manifested when I given regularly in intermental that may arise when its rays have to be reflected from a nitror, and every part was provided with precise and impassions means for bringing it into exact adjustment, and impassions means for bringing it into exact adjustment, and exercise a high sem and good chances of weather. The secure a high sem and good chances of weather, the expediting proceeded, as all the world know, we to the almost inaccessful nearboard executed the world know, to the almost inaccessful nearboard executed the world know, to the almost execute the security of the second to the

cured during the cellpse, and as many more for com-parison. Then after the astronousers returned from their journey half around the world, began the labori-ous and tedious work of measurement and compatation.— —how tedious, only those who have done similar things can fully know

From 60 to 80 stars were measured on the various pairs of plates. Each star gave an equation involving seven unknown quantities, and all these equations, for which mean! (inversity, weeks of tabor The final re-sults, however, richly justify all the pains and cars. Three of the four pairs of plates have so far been worked up—independently by Professor Campbell and for the pairs of plates have no far been worked up—independently by Professor Campbell and for the pairs of the pairs of plates have no far been worked up—independently by Professor Campbell and the clearly and without question. The amount of the shift, expressed as the calculated influence for a star at the very edge of the sun, where, of course, none was observed, came out with values ranging from 130 intuities to minimize the contrasting differences string from the 60 to 80 stars were measured on the

35 minutes for the various places, the sound outstanding differences arising from the minute and inevitable errors in the posi-tions of the faint-star images on the plate. minute and inevitable errors in the posi-tions of the faint-star images on the plate, and in the measurement of these images. The general mean of all the results re-duces to a deflection of 174 minutes at duces to a deflection of 174 minutes at the sum's limb, as against 175 minutes predicted by Einstein. A more complete and satisfactory observational confirma-tion could hardly be imagined, and the world's congratulations are due, both to the great mathematician who developed the theory, and to the great astronomer who has so conclusterly confirmed it.

The summer constellations are now seen at their best. Script and Sagittarius are in the south, sound to against a seen in the south, sound the appendid mass of star-clouds which marks the direction of the center of our galactic universe. Foliowing up the Milky Way we come to Aquila and Cygnus, with Lyras to the Aquila and Cygnus, with Lyras to the control of the c Cephens and Casstopeia to the horizon in the east the most compicuous group is Pegasus, in the southwest are Virgo and Libra, with Jupiter and Saturn brightening them up, in the west Boötes and Hercules, the latter high, in the northwest treas Major, in the north, Ursa Minor

The Planets

Mercury is a morning star at the beginning of the month, and rises before
the star and passes through conjunction on
the 21st, so that during the latter part
of the month he is lavisible.
Yeuns is a morning star, rising at 2 40
X on the 16th, and conspicuous before
the is close to Mercury at the beginning of

the menth being only three-quarters of a degree away on the 4th, but later draws off to the westward.

Mars is an evening star, and is getting very close to the sun. He sets about 9 P M. on the 1st, and is still visible in the twilight, but by the end of the month be is lost to sight

Jupiter is in Libra, visible all the evening and the Jupire is in Libra, visible all the evening and the most compiscons object in the heaves next to the mote afternis in further week, in Virgo, and comes into agardenture with the sum on the full, after which date the most he is not to sight shortly after 10 P M. Uranns is on the borders of Apartius and Piscos, and crosses the meridian at 3 42 A M. on the 150h. Neptura is in (Quance, and alloopsther too near the sum to

time is in Cancer, and altogether too seer the sun to The mote in the leaf querie at 9 P M on the 5th, new at 8 P M on the 18th, in her first querier at 9 P M on the 50th, and full at 9 P M on the 5th, is secret the such on the 21th, and further away on the secret the such on the 21th, and further away on the 5th, 4 Text on the 18th, there is the 5th, 4 Text on the 5th, 4 Text on the 18th, 5 Text on the 5th, 6 Text on the 14th, Saturn on the 18th, Jupiter on the Sist, and Mara again on the 5th.

The Motor-Driven Commercial Vehicle

educted by MAJOR VICTOR W PAGE, M S. A. E

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The educar will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles

Advantages of Bolted Chassis Parts

WHEN we remember that the frame work of the motor truck is really the foundation of the whole machine, it is surprising that so few machines she is surprising that so few machines show any real evidence of applied engineering thought and effort. Practically any re-pair man will verify this by pointing out that the average chassle conling into his hands for overhaulting is an issues as the hands for overhaulting in an loose as the proverbal basket in a large measure tils is directly traceable to the use of rives throughout the frame assembly, and their inability to withstand the con-stant recking and vibration of motor trusk operation. As far as we know there are only one or two manufacturers who have given this phase of design the amount of attention it warrants. One amount or attention it warrants. One of them, a Buffalo manufacturer and in-cidentally one of the pioneer motor truck manufacturers in this country, has been using a boilted frame with outstanding

success for seven years.

In their method of fabrication all In their method of fabrication all bruckets, cross-members, supports and in fact everything attached to the frame side rails is held in place by bolts and heavy type lock washers as shown by the accompanying illustration. The bolts are of ample size and fitted with threads which are held to very accurate limits to assure close fitting nuts. Actual ser vice has proved through years of use and ds of miles of travel that this method practically overcomes chassis And in event that plus ever veloce it is a much more simple matter to draw up on a bolt or two than to chop out loose rivets, drill the next size larger holes and insert new red hot

Another point, which while of second-ary importance in truck life is neverthe-less a decided advantage, is the case with which repairs can be made. For fender brackets, bent step hangers or even damaged frame rails lends itself adily to dismantling and replacement with a minimum of labor and exper for parts The chief reason that ture for parts. The chief reason that this design has not been more generally adopted is the tendency of manufacturers to cut down their production costs in order to maintain the lowest p selling price Experience with motor trucks, however, will prove repeatedly that the cost of a motor truck is deter-mined by its cost of operation rather than its initial purchase price Ther fore, this design is of particular interes There because it goes such a long way toward eliminating this source of chands loose-ness. To bear out the perfection of this design, the only passenger car using a bolied frame similar to that of the truck is a very costly English car.

Suggested Motor Truck Size Limits

Limits

SHALL dimensions, weights and speeds
of motor vehicles be reduced to the
capacity of the weakest parts of the
weakest highways and reads, or shall
the roads be brought up to the standard
of improvement adequate to carry the
biggest, heaviest and swiftest leads that uters of motor vehicles desire to put upon them? These are the questions asked by the Motor Vehicle Conference op in a digest of State laws in Sunnary 1, 1928, presented in a

pumphlet together with a suggested code of regulations for uniform State adop-

tion
The committee, composed of representatives from the American Automobile,
Motor and Accessory Manufacturers' and
National Automobile Dealtrs' Associa Chamber of Commerce and the Ruther Association of America, believes that between the two extremes presented by questions it asks a compromise will be found. This would affect the manu-facturers in that they would design their products and highway engineers would build their roads in accordance with certain specifications evolved to meet the need. In regard to size restrictions the committee recommends a width, includ-ing load, of 96 inches height including load, of 12 feet 6 inches, length, including load, one vehicle 30 feet, combination of vehicles, 85 feet Weight restrictions
—single unit, 28,000 pounds

Why Trucks Should be Loaded to Capacity

ONCE more in the history of the auto Onotive industry it has become necessary for motor truck owners to plan maximum loads, if they are to care for the transportation needs of the country during the next year It is

but it is also due the truck owners. They are doing themselves an injustice when they do not carry all the goods they possibly can in both directions on they possibly can in both directions on evens (rip. And not only are they doing them silves and their business an in justice but their one way londs are an economic loss that affects everybody in

Economy in Small Wheels and Large Tires

the orice to the consumer

A NEW development appears in the automotive industry in the small diameter wheel with the large oversize tire having its sponsors claim, many advantages over the present sizes of propunatic tires. It was pioneered by a taxicab manufacturing company of Chi cage which has given it a thorough tryroad service because the company operates more than 1000 vehicles is built and operated on a cost per mile basis that is not equaled, it is said, in the automotive industry

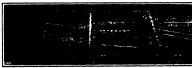
It was with this in view that two vears ago the company started experimenting with the small diameter whee menting with the small diameter wheel and the large oversize tire. Today cabs going to the large municipalities are equipped with a 29-inch wheel, with either a 29 x 4½ or a 80 x 5-inch tire pressure is less, the life is longer and the general advantages many A 34 x 7 tire on a 20 x 4½ rim weighs only 68 pounds including the wheel, tire, tube and flap. In experiments conducted by the cab company in Chicago 29 x 4½ inch tires have thus far given 14,000 miles of service and are still good for many of service and are still good for many more, and it is further pointed out this is regular service for these tires, not special cases picked out. Gasoline con sumption in the oversize tires has been decreased from 3 to 5 miles per gallen, not only in tests with the cabs but also with passenger cars, according to the authority we have quoted

Saving Fuel Important

The recent stir in the daily press about the possibility of gasoline sell-ing for one dollar per gallon has directed public attention to the necessity of sav-ing fuel in every way possible. Here is suggestion to drivers for the saving of gasoline which may be small in amount for a single days run but which will be worth while in a years driving. The common practice of waiting to shift gears on bills until the vehicle has al gears on tills until the vehicle has at most come to a stop is one of the causes of waste of small amounts of gasoline. Tests were made by a government bu-reau primarily to discover the effect of us kinds of highway surfacing material and different grades on gasoline consumption. The conclusion with ref-erence to faulty driving is merely incidental to the tests, but it is one which will mean a small saving to overy owner if the advice of the bureau is h

The vehicles used in the tests were equipped with an ingenious device which nuckes a continuous record of the gaso line consumed as the vehicle move the road and another which makes a simultaneous record of the speed at were selected for the tests and the exact grades of these sections were deter-mined. The specially equipped vehicles, both trucks and cars, were then driven ver the various sections taking the reords of the gasoline consumption and speed with the two instruments referred Several trips were made over each tion, and the rate of fuel consumption and speed for each trip were plotted on a graph with the profile or grade of the It is these diagrams that show the effect of delayed genr-shifting

Exact instructions for the most eco-nomic driving will very with the make of the truck or car but the following pointers will be of value to all in ascending a hill do not wait until the last second to shift to a lower gear If you do you will not only lose spe overtax your engine but you will also consume more gosoline. On one of two tries of a one-ton truck the genra were ed at a speed of 10 mile and on the other at a speed of five miles an hour in the two trips over the san stretch of road with a truck having a total weight of a little over four tons the average speed was approximately the same in both cases. In one case gasoline consumption was at the rate of 42 miles per gailon and in the other 35 per gallon. With more knowledge conreduction can be made in the 4 000,000,-



Details of the assembly of the holted truck-chands

freely admitted that there is at the pres ent time a shortage of freight cars al st equal to the war time lack and dur ing the next year this shortage of trans portation facilities will not be reli to any great extent. It is apparent, therefore, that the motor truck, as before, will have to come to the aid of the raliroads to meet a greater demand for ovement of goods from all classes. The railroads of the country are exert

ing every influence to insure that all freight cars are loaded to capacity and that empty mileage is reduced to a many truck owners who operate fleets, such as moving vans and cartag fleets, such as moving vans and carriged lines and trucks for hauling farm prod-uce to city markets. In many cases these men are operating their trucks to full capacity in both directions. But there are some truck operators, perhaps many of them, who have forgotten the return load propaganda of war time. A careful analysis of the transportation careful analysis of the transportanea field will show them that even today we have reached such a stupe in the rail road freight situation that it is impos-sible for business men to ship when where, and as they like The motor truck during 1928 can be of great aid in truck curing 1822 can be of great his in helping to solve this problem and there should be no trouble in securing ca-pacity loads going and coming if a little effort is made. Such an effort is not only due the business of the country. Several tire communies now manufacture these sizes. In addition to these two sizes, the tire companies are conducting experiments with other sizes of big overexperiments with other sires of the over-size tires. On a 20-inch rlin the follow-ing tire size will fit 20×4½ inches, 30×5 inches 32×6 inches and 34×7 inches. Decreasing the wheel size and menes, recreasing the wheel size and increasing the cross section diameter of the tire decreases "unsprun, wight". The improved riding qualities, it is claimed, are so marked that other improvements, soon to be announced will make the public feel that the cabs are springless. The present development shock absorbers rebound checks and similar devices which have come into vistence in an attempt to make driving nore confortable

With the new type tire it is claimed there is no lost energy every explosion is translated into travel. There is also less wear and tear on the tires. With iess were and tear on the rive Willing the large, no oversity three the ear, it is reported literally floats along on a cushion of air—the resiliency is so marked that all road inequalities are smoothed out by the tires themselves. Travel over rutty country roads, it is artise over rutty country roads, it is said, is without terrors white the dun-ger of skidding, even without chains, is practically nullified. An additional ad-vantage is the sase with which sand and mid can be surmounted

In the tire size as created the air

Recently Patented Inventions

Brief Descriptions of Newly Invented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Apparel

BUCKLE—C J DAIMARR, 212 Broadway, New York, N Y The object of this function is to provide a buckle more cape clailly designed for use on trousers and other garments, and arranged to insure a positive hold on a strap or the like and without having the points of the tongue projecting to bevome liable to tear overlying elobtes or injuring the fingers of the use of the company of the property of the

Chemical Processes
THERAPEUTG COMPRISTION — M.
SANSWERD, 197 Sterling Place, Brooklyn,
N. Y The invention relates to a composition for the treatment of diseases. The gen
that the company of the company of the company
tion for the treatment of disease by local
having hoter-tidded and penetrating properties for the treatment of disease by local
splications. A further object is the prosplications. A further object is the protion liberates a poster-sting anticeptic agent.
The composition comprises sould adjustsize of the company of the company of the composition of the c

tetranine

COMMOSITION SP. MATTER FOR
COMMOSITION SP. MATTER FOR
VAIRS—Texas E. Gisovas, r/o W. H.
Jayra, Jr. Lake E. Gisovas, r/o W.
Jayra, Jr. Lakewood, N. J. The invention
has for an object the provision of a composit
has for an object the provision of a composihas for an object the provision of a composihas for an object the provision of a composiproparation, and highly efficient in the cleansing and polishing function when used on
the formed by artifact and bottler substantially
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and control the provision and vature

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Electrical Devices

AUTOMATIC TURN OFF SWITCH --ALTOMATIC THIN OFF SWITCH—
L S FOTZ, 011 Wattew St. Lanning,
Mich The invention has for its object to
provide as sitch select to provide a sitch select to
provide as sitch select for interposition in
trolled by the passage of the current for
shutting off sail current at the end of a
predetermined time, wherein the switch
mechanism it come red to an expansion
chamber with it client its expansion the
point the circumstance.

in the workmon the capacital and the control of the

once been set whenever any person moves the door to produce a signal, operate an electrical circuit to ring a bell, illuminate a light or perform other electrical indicating functions.

Of Interest to Farmers

SILD—J MATTHON, ITS W Chestrative St. III.—J MATTHON, ITS W Chestrative St. III.—J MATTHON, ITS W Chestrative St. Chicago, III. an object of the invention which is exported by a field from so that the closure is concern when superior by a field from so that the closure is concern when superior by the superior member and any her resultly little and the superior which is a door is disposed, thereby parentiting second. In the superior which a door is disposed, thereby parentiting second. A TTA CH IN NOT FOR USE WITH TRACTURE-BRAWN RITHERS—C. For the superior which is the superior which the superior

of containers.

BEFT TOPPER.—H. L. SPARKS, Box 010, Silhuey, Neb. An object of this invention is to provide a best topper which is the provide a best topper which is they are still in the ground. A further object is to provide certaing means salapted to sever the tops at the desired height, and to dispose of the cut tops at one side of the row of bests. A further object is to provide round in the cut of the cut of the control of the cut of the cut

PARKER, v.O. R. L. Harmm, Simpson, Kas an object of the inversion is to previous and the contract played contract the contract played contract

Of General Interest

Of General Interest

WARHINGUES TRUNK—A. L. Durr and
J. W. MATHERON, 198 Heading Plance,
Floridays, N. The general debate of this
for hanging garments in the waverbox sotion in a meant that the hung garments
for hanging garments in the waverbox
sometics in a meant of the property of
disposed in any one of various angular poddisposed in any one of various and having a
deptha, the two sections forming a complete
trank.

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CONCERTS BLOCK AND THE LIKE.

L. WIRLIM, T. The Area, Malvilla,

WIPER.—G. B. MULZER and J. H. H. M. MILLING AND ALIVERY AND PRINTED AND PRINT Object of the Invention is to provide means and J. H. Mulzer and J. Mulzer and J. H. Mulzer and J. H. Mulzer and J. Mu

relation.

AWNING.—C. B. Nosyrzz, 214 No Founkee St. Richmond, Va. Among the objects of the invention is to produce an evaluar work of the control of the co

indicated. Another object is to provide as indicator which may be friedmanly held on a scale measure or her to indicate in thebas or the work.

FORTABLE HANDLE OF HARMEN, Dos 388, Fox Lake, III. This invention has the another the provides of a handle which may be a support of the provide of a handle which gage the wall of a box, cruis or other oursidate or articles, so that the handle, what ramped by the operator is prevented from the work.

It is in suggestion.

COMBINION BLOOTEUR ANY.

in good shape. The directs is intended to be wised to the control of the control

tank is effected.

SCAFFOLD—F A SAMPSON, Forcet
Lake, Minn The invention has for its object to provide mechanism for use in consection with the neutal three-cornered scaffold brackets for firmly anchoring the brackets to the wall beling constructed, wherein
a satishile damp is provided for engaging
the stroding, the bracket having noune for
construction of the contraction of the conMANNEY AND ACCESSION OF THE STATE OF THE STATE

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consider the champ to support the bracket. WATCH PROTECTION—M GIFTO, NO WASH Protector Corp., SCR. 23. If we conclude the control of the control of the control of a watch from a by the improper reasonal of a watch from a by the improper reasonal of a watch from a by the improper reasonal of a watch from the cover of the watch being made water of this attempt. A further object is to provide a device which appears morely to be a next watch of the cover of the papears morely to be a next watch chain, yet asts to achieve the above-mentioned object.

mentioned object.

SollDEBING HLOCK.—S. R. RANDALL,
Box 384, Sinashover, Ark. An object of the
invention is to purishe simple derive for
press of the sinashover, ark. An object of the
special control of the sinashover, ark. An object of the
permits of the ends thereof being joined to
press the year of the press of the first, with
out enbjecting the stones are in the ring, or
special control of the pression. A further
object is to provide a device which is
adapted for use with rings of various sizes.

sempetations with service stations at the same of the policy of the contract in competations. Note that the policy is a presentant to the object of this invention is no provided to seem of the policy of the polic

control of devices which to elimphe convertible to control of the control of the



April 20 April 100 and 100 and







Pig. 3. Paring fruit on the safety runor principle is made possible by F. Sargent, the inventor of

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is simple and Inexpensive to manufacture.
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will serve as a link for connecting together
the ends of a traveter chain, or the like and
which will prevent the possibility of theti,
which will prevent the possibility of theti,
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Heating and Lighting

parts

FIGUT SIZING MACHINE — H B

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HAVIN, AO Skinner Marchine (v.) Insuelli
HAVIN, AO Skinner Marchine (v.) Insuelli
HAVIN, AO SKINNER MARCHINE (v.) Insuelli
HAVING SIZING MACHINE (v.) Insuelli
HAVING SIZING MACHINE
HAVING

SPINDLE PROTECTOR.-W P WAT-SUNDIAL PHOTEXTOR—W P War-son & o Waton Bilk (a. Phillipsburg, N J The general object of the invention in the property of the property of the ingreen of the property of the property machine from the threads on adjacent spin-dias aboud they break A further object is to provide a presenting means which allows protects him to a certain extent from the ling hit by the flyer while working about the spindies.

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DIAG LINE EXCAVATOR. — A P
STEER, Statewills. N C. The Invention
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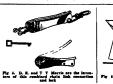
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TUBING STABLILIZER — Y. V. Converted the plants of the provide a stable for the plants which will be supported to the provide a bright medium of the provide and the p tofore been used as a faul, and without any in provide a machine canable of being operativated canages if any, in the usual ceans the provided of the formese being required. In which the heavier and changes, as well as in the first render of the may be said the light render of all may be said the light render of the may be said the light render of the may be said the light render of the light re





nozale or burner proper, capable of being utilized in connection with any type of low grade volatile oil but particularly kerosane, and by reason of the construction the parts will not be damagod incident to the action of the heat.

of the heat.

HINN PIRIPYING AND BALLING
PRIRACE—O 8. PULIDAM, 26th Floor.

FRIENACE—O 8. PULIDAM, 26th Floor.

The investion relative to institute field in a furnace that relative to maniporal for naces. It is an object to so construct such a furnace that the mechanism complexed for increase the second of th

Machines and Mechanical Devices

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and inbriests.

MILLING MACHINE—C KUROLD, e/o
Kluia, 220 E. 27th 81. New York, N X
An object of the invention is to provide a
device comprising but few parts which can
whereby threads may be produced by a very
simple adjustment of the parts without the
necessity for changing the parts or changing
gars to produce different threads or spirals

"THERAID GITTLE WID DESSESSION."

as a the usual custom.
THERAD GUIDE FOR REWINDING
MAUHINES—T. P. KLUPLAR, 575 Pres.
Listo to threat guides for rewinding machines and has for its object to provide a
simple construction in the form of a retructure in place which may be applied to
relative to the provide a simple construction in the form of a retructure in place which may be applied to
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relative to the constructure of the constructure in the co

ity without injuring the spindles. PACKER PLICO_M. S. INEXERN, Seal Beach, Cal. An important object of the investion is to provide a posting ping having means whereby the same may be anabored coneast has been forced into the easing to chose the cavitige adjacent the lower sed of the same, whereby the oil is prevented from flowing upwardly between the wall of the well and the wall of the own of the cavity of the cavity of the cavity of the same, whereby the oil is prevented from flowing upwardly between the wall of the well and the wall of the own of the cavity of the ca

Intry be anchored a prodestermined distance above the lower and of the well.

GRAIN AND SEED CLEARING.

GRAIN AND SEED CLEARING.

GRAIN AND SEED CLEARING CONTROL OF THE SECOND may be anchored a predetermine above the lower end of the well.

within certain predeternined limits.

HEFILI CHAPTRINGE FUR LUBRICANT GUNB-A. E. SIMMONS, 1216 8th
Rt. Barrish, Cal. The principal feature of
the invention residence in an arrangement
conveniently vended in a package which is
suitable for use in combination with the critindex of the principal control of the principal control
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BORING MACHINE.—J A MACEY,
854 Scott Ave. Kannas City, Kan This
receition is especially salapsed for use in
receition is especially salapsed for use in
object is to provide a portable machine hav
ing a plurality of radially arranged cutters
adapted to uniformly censes the wall of the
cut than desired. A further object is to provide a machine which may be result; atthe-plural a radialise and adjusted for opera

from ROAD AND STREET CUTTER.—A. ZILMEASHER, 42 W 57th St., New York, NY An object of the investion is to provide a conter for asphalr roadways, wherein cut the roadbed when pressed by a roller or other weight, the arrangement being such that small sections may be cut, so that the surfaces may be readily removed, and the new apphalr placed therein

new aspitalt placed therein CONTHOL APPRIATURE—T MoLaco 508 Bast Jewey St., Silasheth, N. J. This metallicity of the property of the property of the property for steering gent and has in view to so manipurate for steering gent and has in view to so manipurate to the steering gent and has in view to so manipurate to the steer position desired will be insured. The object is accomplished through more than the steering gent returns unfailingly to position of the see properties.

tion offer an operation
CAN SEALING MACHINE.—M. E.
JOHRSTON and J. O. JOHRSTON, MICH.
JOHRSTON and J. O. JOHRSTON, JOHC
Object of this invention is to provide a machine which will be relatively small and comobject of the invention is to provide a machine which will be relatively small and comprovide a machine in which the can is size.

and a seaming other provides an activity and a seaming check having rotary band
carrying smanling rolls operated in a manuse
to referration and the control of the compression of th

to perform the sealing operation COMBINED NATPER AND SHEARING MACHINE.—M. PORTRACE, 91 Owners Ind. Right of the Sealing of t

operation.

GOLD SEPARATOR.—7 Den. e/o F
McNutt, 17 Leiding St., San Francisco,
color to previous and color to the color t

TORACO FRIATING MACHINE—

With violation to the other sections. A far
EXCHANGE AND ASSESSED AND ASSESSED ASSE the silk thread throughout its entire length FRUIT GRADER.—L. II JUAYUCK, FRUIT GRADER.—L. II JUAYUCK, THE STREET STREET, THE STREET STREET, titellar abject of the invention is to provide a continuous grader for fruit of large caps of y for a comparatively small size. IA will handle out fruit, as for instance peaches or pears as effectively as whole fruit. A will not desarte the fruit in any way during the grading operation, and may be adjusted by grading operation, and may be adjusted for grading persection, and may be adjusted to grading persection.

for grading presentedly all kinds of truit COTTON MCRINERY—J L HART, C'e Hart Cetten Machine Co, Chickasha, Chair The invention relates more par-ticular to the control of the control in the manufacture of cotton to separate the action from the other ambateness with which it is associated, such as hulls, seeds or control of the character of simple not dur-deness of the character of simple not dur-able construction, and comparatively inex-pensive to manufacture.

possive to manufacture
MOLDING MACHINE.—J F CAZIwest, 720 Sc. Bound Free, Los Angeles,
Calif This invention repectally relates to
mobile adopted for use in the manufacture
and other externor work. The object is to
provide a simple and reliable incease whereby
the blocks upon being formed may be removed from the mold without the possibility
model.

of breaking or adhering to the wall of the MATHERMETH, — E. Persanon, po. 15th, the MATHERMETH, D. Persanon, po. 15th, the MATHERMETH, P. of breaking or sidering to the well of the model. IEEE/IEEE. A. R. Praance, Dee 265.

Littleno, N. H. As important object of the increation is to provide a sew light meeting at the provide of the increation is to provide a sew light meeting at the provide a sew light meeting at the provide as well of the increase of

Medical Devices

Medical Devices

NUCLIER.—C. Bruss, DOS W 6th St.,
Cleco Texas. The invention has for its obfect to provide a douches expected and acted
for home treatment, wherein a pipe or mostle
for home treatment, wherein a pipe or mostle
centity to be treated, and having a hase for
closing the cavity, and in connection there
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consecouses internal combustion engine to instantly indicate changes in the interpretary instantly indicate changes in the interpretary instantly indicate changes in the interpretary in the County of the County o

contact break and adjacent the contact see [18] of the operator going between the cars or VALPFIJAS TWOSTROKE, CVCLP
INTERNAL COMINSTON YNGINE.—
H. Braumon and P. Hrvatto, Cvclp
INTERNAL COMINSTON YNGINE.—
Head to the contact of th

Railways and Their Accessories

METAL TIE -W L. VARNER, 412 Eliler Arems, Pratt City, Ala. An object of this invention is to provide a limple and effec-tive means for supporting a pair of rails in

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all the which which pass thereour RAIIMAN TAIL PARTENRR—A. D PRASTRY. 27 Walter Rt. Claremont, West Australia, Australia Amous the objects of clamp and spik, which cooperate to securely taten a rad in place, and to brese the rail graduet hitral and vertical strains. A will prevent the timbers from being rail late, or in other words will cause the tie to everly compressed under the weight of train county compressed under the weight of train

cline occurs may be accurately controlled, will prevent the inherer from being rut late, been operated from a remote point and the sequent of the sequent of

Pertaning to Recreation
(AMP--I I (var 31) lorkson Ava,
Jersy City N J The invention relates
to a game apparatus wher in a large or
small number of platers may entertain
themselves The apparatus comprises a casiling and a rotatable disk, the disk having a
plurally of popertures therein said appetures leding arranged in circular and radial
groups, the circular group representing va-

the apertures in any round aroup arong use with the presence of the properture of th

resulty changed for the playing of the various TOV WAGGON—W II Learn, 408 Craigle Hall, Cambridge, Mass. The object of the Investion to repreted a certaing the new contract of the Investion to repreted a certaing the total contract of the Investion of the Investion of the Investigation of the Investin of the Investigation of the Investigation of the Investigation

genuity TOY — E. P. Pov, Williamsport, Md This invention relates to tops of the automatic or said propelled type. An object is to provide a ministure or toy dirplane having means to cause the same to take flight and more about in the air in a manner closely afmu lating the movements of a full-sized plane of the conventional construction

Pertaining to Vehicles

Pertaining to Vehicles
BPRING WHEEL FOR VUHICLOS—
BRANCH WHEEL FOR VUHICLOS—
Frace. The invention more particularly
relates to a spring or clearly wheel for mofrace are an invention more combine
at multaneously to the wheel an elasticity
which can be compared with the one obthe disadvantages of the latter
SHOCK AISMORIBER—I. M Noar, 940
First Rt., Louisville, Ky. The invention re
HIGGE AISMORIBER—I. M Noar, 940
First Rt., Louisville, Ky. The invention re
HIGGE AISMORIBER—I. M Noar, 940
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HIGGE AISMORIBER—I. M Noar, 940
First Rt., Louisville, Ky. The invention re
HIGGE AISMORIBER—I. M Noar, 940
First Rt., Louisville, 10 to present a simple and
durable arrangement which will premote a
stalled by a simple addition to the spring
parts already in use
FEND HELT.—It between a Roma.

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rious suits in accordance with a carel game, the apertures in any radial group having the game numerical value in Normone 71 (1987). The investion provided with a sail of the substantial provided and substantial provided with a sail of the substantial provided with a sail of the substantial provided and the parts will be substantial to several interfating endious which may be considered and substantial the substantial provided substantial to provide a single numerous parts.

GAME AITMARATI S.-C. F Doere 200

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insider or orchament mounted on a realizate, and the control of th

SIGNALING DEVICE—F. A. GOOSTCA.

85 GNALING DEVICE—F. A. GOOSTCA.

46 Cross St., Whothester, Mass. The inwritten has been to object the providen of
promptly returned to its inoperative position within a casing uspon biner present.

A strict of the providence of the spring within the protice spring which returns the signal hand to
its inoperative position is et all times enterminate the spring of the providence of the providence of the
spring of the providence of the p



Fig. 6. This headlight, the invention of R. L. Rice, Sr., and W. M. Jordon, Jr., netenatically follows the bends in read



Pig. 7 N. Hall is the lavestor of this tage





Our Readers' Point of View

The editors are not responsible for statements made in the correspondence column. Anonymous concerned will be withheld when so desired. mmunications cannot be considered, but the names of

A Suggestion in Automobile Design

A Suggestion in Automobile Design
The de Billey of the Scarrynov Austranta
There is a point in the construction of most make of
atmosphiles which may be its source of many sections.
This point is the freet tip of the freet spring hanger
continually count, the top upting the breats close to the
tip, the make leaves title forward an inch or two threvels
to see body not of billess on the classes and since light
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of speed and the condition of the readolds, charged to
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Resuscitation: Fact vs. Propaganda

To the Editor of the SCHETTICA AMERICAN
May we have space in which to comment upon the
article appearing in one of your issues some time ago,
"Making Use of Gas in the Home Stafe"? We seeme
your correspondent, the preparing this article, sharteed a
leading article in the current issue of the "American Gas
Associations Education," by The Ederdown, to whom refer-

your correspondent, in presenting this article, shattered a scaling article in the current issue of the "American Gas Association Monthly," by The Hendrown, to whom refer and the second of the "American Gas Association Monthly," by The Hendrown, to whom refer the second of the seco

Street.

"Bour pulmotors were immediately sent to the scene and upon our arrival found a score of men and women partially applyxiated from poisonous gases other than illuminating

"Meanra, DeVersick, Wheeler, Hain and Duans of the "Wearra, Polyversick, Wheeler, Hain and Duans of the Twenty-first Birvet and Birty-sixth Street energency six-tion, number of the distribution of the the victims, and were of the dire department with whom they weeked the conjunction. "In a philament department with whom they weeked the conjunction of the sixth of the "In the confidence of the direct department which the use the Consciolated Gas Goognap's polymorous which "In the same of Harry Tonoisky of 112 East 108m; Street, use of the victims, the ever worked on the 60 indusing, Dp. Audors stating on the company's polymorous metal-included such polymorous area that man the first control of the company's polymorous productions the control of the company's polymorous consciousness them. The control is the con-trol of the control of the company's polymorous consciousness them. The control is the con-trol of the control of the control of the company's polymorous the control of the control of the con-trol of the control of th

was very mear death and we called a priest. Sent to the Reception Hospital after we had restored him to con sciousness."

was very many death and we called a priots. Sect to the accounts.

The prior of the prior of the prior of the section of the s

way of jointfyles, the statement that the usual method of using the pulmers is in from being satisfactory? "Pulmotar" is a registered trade name protected by 11. Statement is a registered trade name protected by 11. Statement is a registered trade name protected by 11. Statement is a registered trade name protected by 11. Statement is a registered trade name in the registered to the value of the statement that in some case scale improjer use of the word in the register. As to the attenment that in some case scale inprojer use of the word in the register. As the statement that in some case scale in the register of the statement that in some case scale in the register of the regi

operation
In regard to the last of the objectionable statements viz. "The use of this apparatus (1rt Henderson a specially invented inhalator, known connectedly as the H H In halator) has proved so great an advance over other methods that a number of recover significant intensity the gas company are now working in New York City with remarkable ancesse", this state ment is entirely contrary

nachook that a number of revolue similar materization by mineral materials that a variety of the sale material satisfactory contrary to the force.

The sale of th

except in expert hands, nor do I believe that in its presentate of development it should be used in severe cases.

except in expert human, not 90 a lowine man, no a prosume content of the property of the ball of the property of the controversy has a few periods of the manual and marken over the relation ments of the manual and marken over the relation entropy of the manual and marken over the relation entropy of the manual and marken over the relation entropy. The property of the manual and the control of the control of

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sage on the Fall River Line, for carrying fact express the
steven New York and Baston Your illustration shows
four containers stayed for, and aft on a fate cur the Fall
kiver Line had a crea retrained to carry condutioners In fall
steve Line had a crea retrained to carry condutioners. In fall
steve Line had a crea retrained to carry the other with the content and the stay of the

I niversity Club, Washington, D C

Solving the Water Supply Problem at Panama To the Johns of the Sentrance As Panuming frosh water 710 valid feet per second 85 feet which at 71.35 per cent efficiency of plant will require will be a supplementary of the period Solving the Water Supply Problem at Panama

cott.till

A pumping plant for this purpose, using direct connection that purpose, using direct connection pumping units, should not cost more than \$100 per indicated horse you'r or \$1 000 000 total incestina it. To man the 'shole problem up the animal cost for pump in the water used as for the year 1920 we water used as for the year 1920 we water used as for the year 1920 we great the connection of the pumping the pumping

Fuel \$377 775
Ten per cent interest and depreciation 100 000
Operation

But the total water for power and lockage required in 1920 must have been nearly 2500 cubic feet per second of if the shipping should increase to the equivalent of the shipping should increase to the equivalent of the shipping should increase to the equivalent of the shipping should be shipping the same of the shipping should be shipping to the shipping shippin \$600,000

which power would be required, or $= \frac{3000}{770} = 45$ times the amount as calculated for the locking in 19,20 or \$2,700,000 pr year. The revenue from the canal for one year is now about \$11,000,000 this would be increased by \$4.5 times or \$40,500,000 at the cost for pumping world be approximately \$6', per each of the revenue.

manifestation that was about to occur Mr Lescarboura reports that this san bronism was perfect

56

In the mantime, my button was shin

ing forth unwatched. I was too busy to put it much aftention. The line of sight for these but tons was carefully placed sufficiently far in front of the medium to make it certain that he could not s them if he stayed in his chair. We

thured that if he found the lights we should know that he had been up and moving about. At 9 18, just an induces after we sat down he did find them. That is to say at this moment he asked about them, edlipses had been fast and furious for some time, suggesting that he been traing to make out what they were the asked whether they were were He asked whether they were possible lights giving us a lovely mental picture of a fake scance, at which one of the spectators might produce what the "inc dium" would take for genuine phenomena, to his verlasting and terrifled bewilder

ere ready for the question We explained that the lights were range lights to locate the far wall, at the Monday scance I had had so much difficulty trying to locate phenomena that we had decided to introduce this definite mark of the

rooms extent as a possible aid in this direction. It was pointed out that nobody "need" see the lights save we did not tell blm outright that nobody could see them if he sat quict and that accordingly nobody need be distracted by them. Considerable phenomena had been produced, barring the plea that they distracted the spirits so the explanation was accepted, how

ingly I do not know

It had been found that, even with a poverty of p nomena we could not remember the sequence of the seance sufficiently well. We therefore called in the gid senier summently well. We therefore enter in the alti-of the Dictorpaph Products Company, and the supplied us one of their machines. On Tuesday we put the transmitter on the shift with the devite fun, on Thursday, on top of the lower sords of one of the win-dows quite behind the black serven and out of sight. The wires run out of the window and to the adjoining. The wifes ran out of the window and to the adjoining, room, where a stenographer was posted. Tests made it plain that he would miss some of the phenomena so he was instructed to pay careful attention to my voice, which carries well and is easily identifiable over the wire. I commented upon the phenomena in approprinte fushion as they occurred, and the resulting irkable running account of the two stances at which this apparatus was employed. We can have such details as the somes sung and the times at which they were rendered on Puesday 21 titles were used four of them being repeated. It will now be plain how we know the moment at which the medium an-nounced his discovery of the range lights.

Tuesday's scance was marked by psychic lights, to the number of half n dozen or so. Here we came closer to the last standard than in any other phenomenon But Messrs, Keating, Lescarboura and Lehmann our electrical authorities, thought they

could have been duplicated by drap-ing an electric torch with vari-col ored papers. In traveling range thenticity, if secured to anything as long as the dark trumps; they ould easily have been manipulated from the circle, and in most cases actually from the medium's chair One of them illuminated an object. apparently part of the light, which was variously compared to a melon and to the medium's hald head it might equally have been the large end of the trumpet carrying the light. The lights were by no means sufficiently impressive to stand indently of the other phenomena

At 10 25 there ensued a little in cident which for a moment looked desire of the BORNTING AMERICAN to employ no rough desire of the Keteviric Awardan to employ no rough transpers, etc. we believed that the true character of the phenomena, whether genuine or frauduciat, could be decided without such tactics. I can pledge that this stillude will mark all our seances. Mr Kouting was not aware of this however and either selsed or risped or both a "spirit" which was touching thin with the

Our First Test Seances

(Continued from page 14) trumpet. As a result of this the trumpst was swung, apparently without expectation or intent on the part of

munipulator, and struck Mr Walker rather harder than was in order for a well-con-dusted seance Mr Walker's first thought was of his glasses, and he seized the trumpet. A gentle tug falling to free it, Bert's voice shrieked "Don't do that", a violent

tug was given, and the trumpet fell in sections to the floor in sections to the noor

Mr Walker, in his excitement,
forgot that he had really seized the
trumpet and insisted that he had
only warded it off. Both the mem and his friend were equally positive in asserting that it had been seized and held Granting that they were right, it would be interesting to have them explain, without in

criminating themselves, how they knew it. Bert did not give it away, unless his exclamation quoted above were a code message Mr Walker's explanation and apology were finally accepted, and the sitting west on Thirteen minutes later, another interesting incident was had. At some indeterminate time before this, the trumpet had been doing stunts in my vicinity. When it censed these I had a pretty good idea where it was, and that I could reach it with my feet. With no par-

succeeded I certainly made no noise At 10 38 Bert's voice came of the air high in front of me, and had a long dialogue with me sticking my feet out. I didn't have them out, and said so He granted this, and explained that he meant before, when I had been "trying to for not knowing that I couldn't do We explanation that I had not been trying to trip a spirit was at first rejected as false, and finally, I believe accepted by Bert against

trumpet were the medium a foot Bert and I then discussed at length the conditions. There was too much furniture in the room to soft Bort and of the cleven sitters

his better Judgment

....

The sitters and the equipment for the final sitting of the 24th

...

only six were really advantageous to the psychic power He wouldn't specify, even when urged to do so, but he referred to Dr Prince as a Doubling Thomas, this was presumably because of the incident of the evening before Bort objected mildly to the presence of the books. He told me I was the best sitter there and I books. He told me I was the best sitter there and I tried to make it appear that I appreciated the compli-ment. Finally he stated that they were about through for tonight, requested that a proposed sitting for Wednesday be deformed until Thurs-

day, and promised us some perfectly gorgeous results on that occasion At Thursday s session we had a definite problem to meet. We were noured that the occurrence of the phenomena coincided with the passage of an opaque object about the be assured that the medium did not have his chair, we should have proved that the phenomena were proved that the phenomena were not due to his active intervention, unless he were bringing into the room something which could be found by searching him. If, on the other hand, we could prove that he did leave the chair at these times, it would seem fairly out of the

it would seem fully out of the question for him to hope to establish his phrenuments are greatinely psychic. We record a piece of thin fiber board, two feet. See we sufficiently, either that the properties of t

the next room With the board placed beneath a chair and properly connected, the remote lamp would burn so long as the chair was occupied, and would go out

when the occupant arose We tested it out thoroughly in the position in which it was simed to use it, and found that I (weight, 125 pounds) could operate it infallibly The medium weighs ore than this.

e detection mat was placed under the large r that covers the floor of the library, with several small mats surrounding it there, to prevent its presence from making too marked a jumping-off place on the floor The wire was carried under the rug and out the win The wire was curried under the rug and out the win dow, and an observe sat at the lamp in the adjusting room with the dictograph operator. Her sole function was to announce when the lamp went out, and, by means of a stop-watch, the period during which it remained out. Those announcements were incorporated by the stellographer with his dictograph account. We were faced with one difficulty, which we mailly

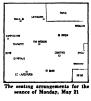
We were faced with one difficulty, which we finally turned to an advantage. We must be assured that the chair was not moved about. We built up, of lathing, a cupe on the finor that fitted saugity about the four legs of the chair. We tarked this to the carpet, anchored it further with addiestive tops, and made it solid at the corners. It was not at all immovables, one could have moved to the contract of the cont present upon the modium that we were envious to be able to say, at the conclusion of the sitting, that none of the chairs had been moved. Those of the outer circle we had tled together securely with twine, but pointed out that we could not run twine across the circle to his chair for fear of tripping the "psychic operators' or otherwise discommoding them So we had adopted this device. It would not, to be sure, pre-

vent him from moving his chair if he were bent on moving it, we pointed out, but it would make it possible, and easy, for him to occupy it for two hours without moving it We had hoped that the insistence upon this perfectly absurd test might distract his attention from the real ones which we were using Such distruction was a bit nec such distraction was a bit beces-sary, because one could sense the additional springiness of the floor under his chair—at least one could when one knew that there was something there

As another item in this distraction (we were using the magician's stuff, it will be realized), we had the medium and his friend call at our office Wednesday afternoon for the pur pose of discussing controls

suggested several things that we had no intent of doing, to get their reactions. When we asked if there would be any objection to talcum powder on the floor, we were told no, but two points were made first, the spirits would perhaps leave a trail in the talcum which might be mistaken for the trail of a human second, we would have an awful time getting the rug clean again, and perhaps we would better realize this and put the talcum in pans, here and there about the floor. We were deeply touched by this

It had been the medium's practice, in sitting at home. to employ, quite freely, luminous bands about the wrists of the sitters. We were going to follow this plan, and the medium knew it Nothing was said to us about any departure from the procedure which one would suppose these bands to imply We supplied bands of adheeve tape, with one or two luminous buttons pasted on each, and these were very effective in the darkness of the seance room. But when we got nicely settled in the dark, the medium suggested that we hide our wrists, and display them only on call, when phenomena had come and it was in order to account for all the sitters. As a matter of fact, this turned out to be a necessary step, because the presence of all those head-lights was quite distracting and with them visible. very scratch or wriggle by one of the sitters produced shooting-star effect that was destructive to the morals f the whole circle Yet under this procedure, the phenomenon is gone by the time wrists are called for and displayed. So this very much vaunted bit of darkunghayed. oo inin very much valinted bit of car-seance technique will not play any further part in our plans, and we shall attach no further value to seance reports where it is used as a control. In our own pres-ent case, however, it helped greatly in directing the medium's attention away from the things we were really banking on to check up on the phonomena I think it will be agreed that this is a proper and very (Continued on page 64)





of Tuesday, May 22. A and B are the initial and final positions of the guitar, respectively



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Science Notes

Big Yale Telescope for South Africa?

—It is possible that a powerful telescope
will be placed somewhere in South Africa to
view some attra which cannot be well studied
from the northern hemisphere.

from the northern hemisphere.

The British Museum Has No Place for Films—Aithough the British Museum has over fifty miles of shelving for books they have no apace for the safeguarding of lastoric films like those of the funeral of Queen Victoria The Was Office has prevent films of the British Army during the

The Metric System—The metric system is proceeding about a regarded the proceeding about as regarded the proceeding about a refriction. Consequently, which was made extracted the regarded with a warming the regarded with a warming the regarded with a warming the regarded with the confused by the circumstance that the constant of the British galon is greater than tot of the British galon is greater than the regarded with the

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Celtivating Perfusion—A process, the Investion of M Daniel professor of beduty the process of the proces

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BCAUSE of the general scarcity of labor and the stoppage of some sources of supply, wages are advancing rapidly, are especially handrapped because they cannot compete successfully with the appeals made by the construction industry. One effect of the scarcity of common labor is the installation of more and more labor saving machinery—specially of material handling equipment. The sales of Barber-Greene Bucket Loaders and Portable Conveyors are greater than they have ever been for a similar period—greater even than in 1920. Much of this increase is due to general conditions, but even more is due to the superior advantages that this equipment has to offer flows. In the sales of the superior advantages that this equipment has to offer flows. The Barber-Greene Euckeyers, for instance, can be extended to any length up to sixty feet by the addition of standard threshot scannot have a supplement of the sales of the superior scannot have an automatic disc feed that operates of efficiently that it eliminates the need for hand-shovel clearups. Send for our catalog A-B and additional application data.

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Science Notes Porty Million Marks for an Elephant and a Hippopetamus.—Hanover has been obliged to sell part of the Eos. A French antheal show paid 40,000,000 marks for the two animals named above.

two animals named above. How Frances Selved Daylight Saving— Summer time received a set best when the French Calbinst decided not to interfere with Standard diese, but that everything should start half an hour earlier Moon trains leave at 11:80, the theaters raise their cur-tains at 8 instead of 8:30, and so on

Spiritualist Sunday Schools Attacked.
Spiritualistic Sunday Schools are making -- Spiritualistic Sunday Schools are making a certain amount of progress in Empirad. About 18,000 attend such services. Efforts are being made to influence some of them to become medium. This has resulted in powerful attacks backed by well known persons.

Greece Adepts the Gregorian Calendar.

—Beginning with March the Gregorian eal-endar was adopted for civil purposes in Greece. As Etunia has apparently adopted the same course the old, or Julian style, has become practically obsoleta The Greek has become practically obsolete. The Greek Church is not at present adopting the re-form, the reason being the expectation of the speedy adoption of other calendar changes in the wort, for which it prefers to

Changes in the west, A plan to map the entire sky of Entrops is being onto map the entire sky of Entrops is being out. Weather the entire sky of Entrops is being out. Weather Burney, which shreetly has mapped the sky of France. Weather observers and the entropy of France, Weather observers and the entropy of France. Weather observers when the entropy of France. Weather observers over a beautiful to make the entropy of the

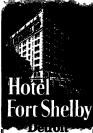
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provided to prevent collection of water in rainy weather.

Cooling Methods for Large Trans-rainy weather.

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Mechanical Engineering Notes Magnetic Separation of Coal From Slag has largely replaced the older method of separation by varying specific gravity wherein water was used dry magnetic system the varying separation

iry magnetic system the varying m properties of the ferric oxide resulting combustion of the iron pyrites and the bustible matter are used.

bustible matter are used.

Brass Casting.—Not many years ago
the chemiat was unknown in the brass busi
ness, the custor playing "chemiat" himself
The matter castors mixed their brass alloy
with a great deal of mystery but very little
caset knowledge. Nowadays the temper of
the brass is closed by pyrometers, mercureaus
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static and other tosts expose its weakness.

static and other tests expose its weakness Keeping Valwe Clean.—First put into practice by an automobilist to keep the author of the control of the control of the author of the control of the control of the strong of the control of the control of the strong of the control of the control of the strong of the control of the control of the moved up and down, this washer was brought moved up and down, this washer was brought into contact with the bearing surface every time the valve rose. The result was a valve slaves free from cerbon

always free from carbon

Centrifugally Cast Iron Pipe requires
heat traduunt because the molten iron, be
ing thrown against a raphilly revolving wa
ter-cooled metal model is more or less chilled
and, when the pipes are remost from the
machine, they are more or less hard and
brittle. Pipe made in saud models do not
have to be heat treated. The furrance used
is oil fired, its beat being controlled by a

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dependability, you'll find that these sturdy motors possess a known merchandising value that will prove of real assistance in marketing your product,

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Steel Passenger Cars for India are being made. These will be 65 feet long and will have seating capacity for 100 passengers. Civil Engineering Notes

The Proposed Mid-Scotland Ship Canal for the navigation of large ocean steamers between the east and west of Scotland is now under discussion.

The Ballways of the World had an agreement least of 76,800 miles in 1900. The Ballways of the World had an agreement least of 76,800 miles in 1900. The process of the Pollman care. The besidences attend out half way from the side of the car in the other process of the process

A Cantilever Roofed Stadium for the 1924 Olympic games is to be constructed at Paris. The roof will overhang a distance of 131 feet, the principle of the cantilever being need permitting support at the rear This obviates the understrable obstructions to view in front of the spectators.

An Underground Moving Pathway for Paris is the subject of invertigation in that city Thirteen plans were submitted and five were retained for further experiments. Of these, four work on the principle of parallel bands working at graduated speeds, and the remaining one slower down for each

atop.

A Six-Wheel Truck for Freight Cars has been perfected and treed out by a Balti more steel manufactory. In these trucks each asize is free to assume its true radial position on enters. The content rate seats as the pitot and the other two are hinged to the frost and errer side. Six purpose is to insent resistant on curve and to cut down warr. In the hacks and tracket.

wear on both wheels and tracks.

Roller Bearings for Locomotivas are being tried out in Sweden, after the failure of ball bearings to stand up under the heavy work. The locomotive department of the Swedish State Railways states, according to The Swemer, that the tests with this bearing the state of the Swemer centioned sufficiently long to the whole the centioned sufficiently long to the whole the sufficient participation of locomotives. Citics of the sufficient participation is sufficiently for locomotives.

antistactory for locomotives.

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The MONARCE In these Easters Late (III transit and III transit and II tra



THE MONTH FOR MACHINE TOOL CO.

Miscellaneous Notes

Water at Auction.—Aden is one of the hottest places on earth A heavy rainfall recently filled tanks with 3,000,000 gallons of water which was sold at auction

recently mice tanks with \$0,000,000 gallons of water which was sold at auction

National Park for Poles.—The Society of Friends of the Tatra Mountains, Poland, is working out a plan for transforming the mountains into a national park on the lines of Yellowstone Park.

Esperanto Congress.—An Esperanto Congress will be held at Nuremburg, August 2 to 8, 1923. Thirty five countries will send 2500 delegates A play, Lessung's "Nathan the Wise" will be given in Esperanto.

Ontario Gold Fields.—The gold fields of Ontario have been producing gold for several years, the ontput of ore having war ranted large extension in militag plants. The newly discovered gold fields of Labrador may prove to be a second Klontike.

The Largest Thermometer.—Atlantic City has many novelties to interest victors. Recently a thermometer 60 feet high has been erreted Promenaders on the board walk can read the temperature a fill away Lights on the board indicate the temperature.

An Expensive Hobby.—A stamp exhibition in London has been insured for mearly \$10,000 000 One single collection was insured for \$500,000 One advantage of a stamp collection is its extreme portability All the stamps in the world in albums would only fill a small ateamer trunk

only his small steamer trunk

A Large Envelope Order—It will require \$564.289.000 envelopes to inclose the
mail of the Concrement next year and, as
an indication of what these figures mean,
the Post Office Department announced today that a contract had been let for 140,
000 000 official surelopes for that department
alone at a cost of \$178.001

alone at a cost of \$17x,901

Trails: Troubles of Paria.—There are 80,000 automobiles in the streets of Paria 1000 cumberosm autobases 1200 street ears, 600,000 bicycles considered the worst horse draws which can be suffered to the street of the paria 1000 cumberosm who has been in Paria knows that it is as much as been in Paria knows that it is as much as the sum of the principal form of the principal form of the principal form of the paria 1000 cm. Specifical form of the principal for paria 1000 cm. Specifical form of the paria 1000 cm. Specifical form of t

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Our First Test Seances

(Continued from page 56)

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ed genuine or fraudulent, or whethe
sinion at all he held as to his status.

believed genulas or frauntism, or whether no opinion at all his held as to his status.

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out exception, that he was out of it. In all he left it fifteen times, for periods as long as ID seconds at a time. There can of course he no valid reason for this; and, since he was parallelism between the absences of the medium from his chair, and the phenomena, is displayed cleawhere. It should be emphasized that all his absences from the chair are listed in the table on page 14 During the evening the medium discovered. During the evening the medium discovered During the evening the medium discovered.

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peated on Thursday, whather it would do the state of the

you?

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Bird I don't quite pet it try again
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Harry?
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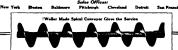
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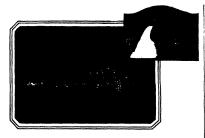
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Radio Notes

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Static, as a matter of fact, does not be a supported to the state of t eithi in grater proportion, so it seems than the music or talk being broadcastrol and Unforgeness Expense.—It has been taken to make or talk being broadcastrol and Unforgeness Expense.—It has been taken to not taken the sections to sak their listeners to write its, phons, or telegraph, satellire how the probability of the section of the predicts and, if anything, it has sided another thrill to anything, it has sided another thrill to see the section of the predicts of the section of the predicts of the section of the section

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Wireless Telephony and Telegraphy
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None of the wavelengths goes above 900 meters. This is important to affatours, as according to a plan proposed to the recent conference the large stations might have had wavelengths up to 700 meters, which would have necessitated the changing over of many

wavelengths up to 700 nesters, which would be received in the changing even of many receiving state. Besides the Class B stations, which broaden to long datences, there are 500 Class A. These will be allowed to retain that wavelength or one none into a special hard because of the change of the c

quarters.

Beginning May 15, inspectors will check
the wavelengths of stations in their dis-tricts.

the wavelingues.

It was stated that any station now operating on 360 meters has the privilege of remaining on that wavelength. It is also emphasized that the assignments of wavelengths are for cities and not for specific stations.



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Elevation and Range of British Naval Guns

(Continued from page 26)

(Confessed from page 26) shock to which the structure is exposed when the run comes crashing down in recoil. It may were be soluted whether the speed with the run comes of the run of the

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Industry in the Philippines (Continued from page 29)

(Contraced from page 25)
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No matter how nearly perfect the mechanism of a lift truck may be otherwise, basic efficiency is impaired unless the wheel mountings are modernized

That implies Timken Tapered Roller Bearings in the wheels Timkens are particularly adapted to this service, because

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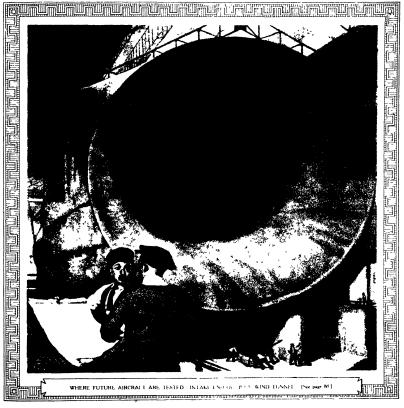
TIMKEN Tapered ROLLER BEARINGS



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FOR next month our informal paychic funestigation moves back to America Shortly after their Joint return to New York, Sir Arther Comm Doxic found it possible to arrange for Mr Bird several stances in our own Middle West These sittings were not test ones any more than those which Mr Bird had abroad—they were in fact but an American supplement were in fact but an American supplement to his European tour part of it rather than of our formal investigation here In the September issue he tells of a sittin, thus held with Miss Ada M Bedinnet of titus held with Miss Ada M Be-dinnet of Toledo regarded by spiritists as Autoria of forenost medium and aircardy known by name to our readers of as far buck as September and December 1922 As usual VR Hird tells what happened without hasarding any opinion as to causes and we are sure that every reader will agree that pleasity happened to make a fas-inat

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attention once more atontion once more In connection with this story we shall have a handsome drawing of a typical large modern power tribute to making the whosels go round and the Juice flow out ower the train mission lines in his drawing will go a kage was tward giving our readers a better understanding of why it is so commissal to manufacture power in the borget possible units

Till'N there is a remarkable new de-remarkable new desired which promises to carry us as far ahead of the cord tire as the cord is abend of the fabric shoe and to do even more than this fir the rubber industry as a whole one of cut special writers will cover this terminal to the contract of the contr One of our special writers will cover this but unrelated is the report which we shall soon have of a long series of impact tests aimed at giving us a better idea of what happens when the tire hits the road. Mr L D bmith will centinue his remark all is still of stories showing how the shad; sile of the community does it his next contribution being on the crooked gambler who plays the cards the wheel, or what not with an artificially big per centage in his favor or with an even n immediate advantage than that Mr L. Lodian will favor us with another of his interesting tales of the curious things that the fereigner in our midst eats and that we can buy and sample if we will but explore the little stores of our foreign

DI RHAPS a word ab at this contribution will not be smiss. Horn in Connection the anton to the income in connection the hast to use his own language, to ured from Manhattan to Mongolia from Iray to indica from Iray to Mondo from Iray to Mond in search of the things that he has learned to cut five the usand miles away When he has collected a sufficiency of amples he brings them in and has our staff photographet pose them and then soes home and prepares a manuscript de scribing them. Sometimes we wish we weld be as enthusiastic about their odors as Mr I odian is about their flavors but

HIS electrical statistics upon which we This electrical statistics upon which is based the graphic statement of page 771 in our June issue were borrowed from the Pierrical World which got the cost in time and them together at no little cost in time and real noney Our indebtedness to this con temporary should have been acknowle and our fullure to give this acknowledgement was due to oversight, which we now

A ND here we are at the bottom of the second column and no space left to puff out our chest and brag a little about the current issue As usual we feel that it is the best yet and we hope all the rest of you will feel just the same way

Another 250,000 "Miler

MADON SHOOL STATE OF THE STATE

After delivering more than 75,000 miles of service to the city of Auburn, New York, this Model "D" 1911 Franklin, liturated below, Aurushaed Arthur Maddocks more than 175,000 miles of service without replacement of a single Timken Bearms. A total of 250,000 miles.

120,000 miles of these quarter million miles of service were delivered in and around the mountains of Colorado.

On the 28th day of April, 1923, Mr. Maddocks furnished the following affidavit made in Denver:

"During all the time I have had the car, which is from April 1, 1913 to date, the Timken Bearings were not replaced until April 22, 1923; and the Timken Bearings delivered to a representative of the Timken Roller Bearing Service and Sales Company are the same identical Timken Bearings that were in the car on the date purchased by me, and I have every reason to believe are the original bearings put in the car. From the present condition of the bearings in question, I believe they would easily last the life of the automobile, which is at this time in first class shape and which, during the next thirty days, will be converted into a service car to be used for towing."

Twelveyears of service showing more than 250,000 miles without one single Timken replacement.

The Timken Roller Bearing Co

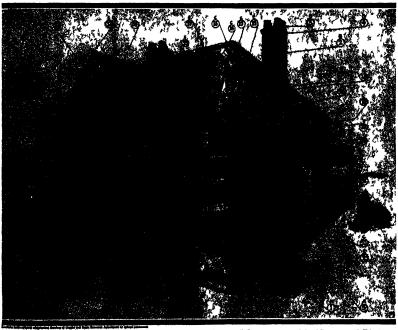
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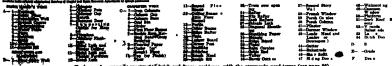


SCIENTIFIC AMERICAN

THE MONTHLY JOURNAL OF PRACTICAL INFORMATION

NEW YORK, AUGUST 1923





Invention and the "Grifter"

Gathering in the Foolish Dimes and the Heedless Dollars at the Summer Amusement Parks

By Edward H. Smith



bill other Sunday at Coney Island swue of the water of th

nondulous hall. The things as easy as ple—as soft as syrup!" cried

"The things as easy as ide—as soft as ayrupl" cried the barrier indistinctivity.

The hervely dressed young man paid his dime, palled soft the baid and let it go Sarrely it was present to be precised as a supplementation of the party of th

The concessionaire or grifter, to give him his native name, had indeed let the ball go just past the shoulder of the pin on the right and again it had travelled an ellipse, but so narrow that it touched the left pin as it swung back and sent both

left pin as it swung back and sent both of them topoling down arrived the immediately again, friend the pin and the sent sent and the sent arrived the sent and t

"Let me do it, let me!" she urged, and the grifter

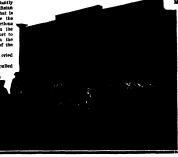
gallantly indicated to his sputtering customer that this galanty indicated to his squitering cumomer that this was the proper maneuver. She tripped on her spindle heeled, carmine shoes and took hold of the heavy ball. After a good deal of giggling and simpering she aimed her shot. The cilipse

gagging and simpering site aimed nor shot. The ellipse "No, no, no, Miss" complained the grifter in earnest imitation of torture "You must't swing it wide You must cut just paliet the shouldah of the pin heah Let

handed over a tinsciled doll of the girl's selection and invited her to try again She looked for encouragement to the young man and then did risk half a dozen more shots. But now, also, she could not win Her escort, still angry over his own failure and discomfited by her single sucminure and discomitted by her single suc-cess, took the bell and began to shoot again. He missed thrice and went away faming, having paid shout two dellars for a dell worth forty cents. The call of the bilthe entrepreneur of summer amusement followed him down

"Step right up, ladies and gentlemen All a matter of skill, friends. All skill Just a game of skill."

But was it? And when the millions rush to the summer parks, the sea shore, the pleases, the street carnivals and



Typical balloon blowing game. The rubber balloon here is in the threat of a frog; it expands as the customer plice a lover, and the winning frog is the one that creaks first. But—the game keeper usually has mechanical control that enables him to make any given frog win

wherever grifters and their alluring games are appearing this summer, will it be a mere lack of skill that will need some millions of good movel into the potents of them and rancals? It wann't in the case of the man considerable that wann't in the case of the man carefully alastic off on the bottom, so that when he set it up for the trade it leaned away from its fellow perhaps half an inch at the top. That was sufficient to send the ball into an ellipse wide enough to miss invariably But when he wanted some one to wis, in order to encourage further play, he merely turned the first mats. Now the ball sent jour part the incleasing fin came almost directly back and winning was un-avoidable

A trick of this sort is called a gimmlek or groupe—and that term is the Aladdin's ring that gives us assame into the land of summer foily, of grifters, concessions, games, rides, hot dogs and ballyhoo. One seldem stops to think of it, but a very large

country of dailbel inventors is constantly bear related for the summer parks and street man-related for the summer parks and street man-ing of these men are genimes of so compose order. The chate-be-chutes, the figure A. the great could relitary the various machines, the mechanism of the whirling machines, the whitch wave and a hundred other "yides," from the humble caronard other yides," from the humble caronard relative power and some contain prodig-lative parks and the production of the latest the parks of the previous signatury. Such inventors as 8. F. Jackman, originator of the gravity rides; Itself, and the walp and other darks, Thouspon & Dundy, who developed Luna Parks, and the Chaevers, havenors of the like them were downed with imagination and the power of originating and applying ideas. Ridel it was, by the way, who made the power of originating and applying ideas. Ridel it was, by the way, who made the power of the product of these beginning with the Chicago World's Pair in 1888, when the first of these big plea-ture machines appeared in the shape of the Perrix Wheel and the Charto the Chaton have set up their strange machines all

Ferris Wheel and the Cauts (no cautes, and coming down to date, such inventors have set up their strange machines all over the country, in parks and grounds dedicated to the kind of joy these inentors made popular

It is not of such men, or of their legiti-

histens of 2.

The state of the joint' is the griffer's wernacular for a booth where the customer gets fair play, "strong joint" the opposite These manufacturers keep numbers of inventors at work, year in and year out, making new tricks for the old trude, for the public is ever finding out the secre-of some game or coming to suspect it Therefore, it is

one trace are many part of the control for the control for the control for many part of the control for many part of the control for many part of the control for many colorful day's mast summer, why the control for many a colorful day's mast summer, why the color for the color for



Plum bebling; an efficer inspecting the setfit to see whether it is really game of skill as represented. The object is to drop best plus with one or

rkich fact comes the very ld notion that hunchbacks and halfwits are lucky hey have been carried about g the mountsbanks of by the mountsheath of many cantral the said always allowed to win, so that the galled crow of might be tempted to play and lose its cash. On the other hand, if the woman beade you suddenly withe with hee first or second play and dashes off with contral the said print, you with some fastly print, you have been always the print of the parties of the p inrows the game her way both to encourage play among the onlockers and to send her wandering about the park with her eye-filling

the park with her eye-filling award, thereby advertising the grifter's game Perhaps you have yourself stopped up to one of these games where several were playing, and won substanti ally at the first venture. If

any at the brac venture. If you will discover that this doesn't happen unless there is a crowd behind you Your good fortune is the lure by which the others are coaxed on to ill

coaxed on to III
But perhaps the simplest way to make the whole
bankmar clear is to take up a few of the representative
are as a few of the representative to the company of the representative
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to the company of tawdriset and cheapest articles. However the griften always had is hand a few rines which were larger but not preventilly so, seen with the handed see at a little to a strengthly so, seen with the handed see at a little leaves or poor to staining, the shillest mor company called shill, stepped up and was of course fives some or the larger true little staining the shillest mor company called shill, stepped up and was of course fives come or unbriefly and the proof of the larger fire shill shill, stepped up and was of course fives come or unbriefly the crowd, of course surand forward to take advantage of a "turn in the lark". But the greatment behind the Gones hought games belong to the order known as meaning of any larger rings just the Gones hought games belong to the order known as meaning and should be should be

ever, in these roll ball games the big pieces can be won if one has patience and meney snough to strick to it. In the "fissis, and slum! hoopis booths, on the other hand, the big prises are more won by any but are never won by any but the shillabers. Watches are much used in these piaces and the developed of the piace and the developed grifts and in the contract of the contract of the piace and the piace and the contract of the piace and American movements in actif gold or even platinum caises, watches, worth up to two hundred dollars. But two hundred dellars Bot on the rack with one or two of them the thinsplecks are usually change watches, brunn magain stickplus and the lips. This game is gim added in one of two ways Rither this beau made the Sabbithle watch is a little by large for any of the higher is undertied or there shall not be the party of the single is undertied or there shall not be the party of the single in undertied or there shall not be the party of the single for the things in undertied or there shall not be party. In



Poker with darts-try to get four aces if you can

the former case nothing but the sium is won in the latter only a shillaber is allowed rings large enough to do the trick. You pays yer money and you takes

There is always about all carnivals parks and stre fairs the kind of man known to the inner circles as a half wise boob one who can mest easily be duped be-cause he has that little knowledge that is so dangerous For the humiliation of this kind of man the grifter has various mechanisms containing a double simmick helmer is acquainted with the first but n the second

Some years ago I was standing in a Chicago am ment park when a young man f the know it all than acter strolled up to a booth where it well known grifter was conducting a little trick p×1 Lame seper tried to interest this youth in his as rt but met with the swag, ering answer

want the swaggering answer
'Wortha try n to de! Kid me? I'm wise bo
All right som said the grifter and immediately
pulled out a curiously designal knife. He opened the
blade and began carring a bit of the lade and becan carving a bit of word. The egotist s eves followed the knife In a moment

Betcha a quarter you can't clos it said the grifter

The young man's breast swelled with injured dis. The ____ I cant ' he snaps I

The —— I can I he snaps I
The bet was made and the knift hunded over
The she would be could not close d wn the hade
to could not hade to the state of the could not budge it from its set at whould destroying it
The grifter laughed loudly pecketed the wise young
man as money and benignant's aboved his new friend

the gimmick, an o ept the blade from being closed down. The suck was delighted, tried ti catch three or four times un til he felt sure he under

ill he reit sure he under stood it and then offered to buy the knife. The griffer, of course, refused to sell. At this moment a stranger came wandering along and stopped to gape at the pool game like any countryman. The sucker who still had the knife in his hand, as per ar-rection to the country of the transport of the country of the line and offered to bet he tion and offered to bet he couldn't close it Again a twenty five cent wager was
posted and the stranger lost
The granulck was shown him
and he too, studied the
thing carefully Studently
he said to the wise young
mun ustup a routle speech
and this is easy I be't I hat toose it an you can't
cen it

open it

The wise young man of course received such a roposition with derision 'How much il you bet? he demanded 'Fifty dollars

The griftet seeing from the wisenheimers attitude that he didnt have that much, undged him and whis-peringly inquired how much he was short I only got forty said the dupe let him urged the grifter under his voice "I'll take the other ten

take the other ren

3n the bet was made the newcomer closed the knifs,
the grifter held the stake and the clever young dupe
tried to open the blade I for itself till the was bine in the
face and couldn't stir it. Then the grifter reprectually
paid the bet to the stranger who wont his way repaid to loicing

Durn it said the grifter when the other man had gone That guy knew moren I did. I didn't think there was a double gimmick on that knife The stranger needless to say had been the grifter s

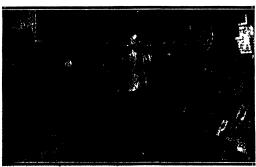
Such ingenious little instruments of fraud are b Such ingredious little instruments of fread are being inserted and municitured catastarity and disserted in fact of news rome as they become too widely known for many some as they become too widely known for many some as too lake walked hit parks and the many some as the service widely known to make the too the service of little the cane buckets or the or the tringle of little wooden harvels. The circle is to make three ladls to seed into these receptacles at short many stay there All of its harve riged it again and again It looks extravalantly simple but the balls always bounce out again Let one toes them ever so

gently out they pop and the prize is lost. But the fellow next to us makes them stick How come?

This game is called Huck-ery Buck or Huckely Buck, depending on whether on talks to an Fastern or West ern grifter and it is man aged in a hundred fashions It is one of the classics of parkland Of course it is gimmicked Last summer at one of the principal parks I saw a mellow old grifter a man who had come through all the imaginable splendors and vicintitudes of life with a faint and smile playing a raini and smile playing live chickens or ducks against the dimes of the in nocents. No one won till I stepped up under the arm of a famous old outdoor gym nast The grifter recog nised us instantly and in vited us to play My friend did so at once and soon was four ducks

Keep em for me till I me by will you?" be come

Rurest thing old man," said the grifter without the (Continued on page 155)



ckery Buck. The trick is to make the exceedingly springy tennis balls stay there is no chest-except that it is just naturally so hard to do that you more than pay for any prine you win.

Camouflage and Carpentry

How the Housing Shortage Has Played Into the Open Hand of the Jerry Builder

By A. G. Ingalls



URING the past spring there has been such a boson in householdling as the American and the such a boson in householdling as the American and the such as the such

them that this article has mostly

Thousands of houses are being put up by speculative builders, a large portion of whom are doing good, honest work. But the re-mainder are being built hurriedly mainder are being built hurriedly carelessly and choaply In sym-cases the builder, after he has re-ceived his payment, does not care how shabby a house will get to look. The worst feature of it is that, to The worst feature of it is that, to the eye of the average person who she shows poor so in not familiar with the building industry, the products of the good was discussed in the products of the good was allowed to the bad builders may not appear to differ in quality, to may appear to differ in quality, to may appear to differ in quality, to may be appeared to the products of the products of the products and the products of the products are the products and the products are the products and the products are the products and from the point of the products are the products and the products are the products are the products are the products and the products are the

For by the very nature of a house it is unnecessary purposely to camoufinge bad work. The wails, when completed, concent it.

completed, conceal it.

Thus it frequently happens that the home-hunter
falls to the wiles of the real estate salesman who, in
painting an entrancing picture of the joys
and advantages of owning ones own home, knows only too well that his de-piction meets with its long-since-estab-lished counterpart in the mind of the prospective purchaser—and his wife. The pretty little bouse is bought on the plan of "a little cash and what you now pay in rent," but because it is not properly built in the beginning, long before the final payment has been made it will have become a shabby, sugging structure with little resale value

Admittedly, it is very difficult for the Admittedly, it is very directir for the average person to ascertain whether the house the speculative builder has creeted and is trying to sell to him after completion, in sound, or whether it is "jerry-built' Buying a house under such effectmentances is, in part, at least, a gamble

beam! High Rg. a broke state; ever the control of t It is like swapping jack-knives "unsight and unsee grab-bag affair in which the most essential parts of

mounted bishes and fishes. Keeping up the periodical payments on such a house will have become a matter of "paying for Goad horses."

The salesman who is interested in disposing of what he were to be deproyabil tomose tousist, deroses his prospective buyer and he is only too glad to have her he have to be deproyabil tomose tousist, deroses his prospective buyer and he is only too glad to have her house to be the prospective buyer and he is only too glad to have her house to be the same had been and to look it opposed to be the same had been and to be the same had been and the house as for the vote to successful to the same had been and to be the contraction details, but because he knows she is the some any of the two to successful to the same and the beater had modern to be the same and the leader pipes of copper are ago to loom higher in the estimates of the same and the leader pipes of copper are set to loom higher in the estimates of the same and the same and the same and the same and the same are set to loom higher in the estimates of the same and the same are set to loom higher in the estimates and the same and th True, the tiles of the bathroom may

True, the tiles of the bathroom may
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meight
opinion soorly set, so that they will soon
allow water to leak down on the
ceilling below, the fireplace may
prove moky because it lacks a
signed fireshelf in its fine, the hardwood properly designed fireshelf in its fine, the hardwood floors may be very thin and may have no sub-flooring at all, while the shining varnish mely he for impection purposes alone, peeling and wearing off before the home is a month old. The addition of a few copper leader

the cottains by a little carin indictionary pushed by the learn-healther, and the collect floor in quicking pisseds, the learn-healther, and the collect floor in quicking pisseds in, this is a rether difficult thing is realax purpored. When the collect floor is seen to be more than the collect floor of the collect floor in the pict. In soon, collect collect floor is within the collect floor, and collect floor in the collect f

weather-shape cross-section and will add upon the perfectly fat has a first ham.

The coltar floor is generally made of conscript subsoluted by made to conscript subsolute by made to conscript subsolute by made to the conscript subsolute by made to the course of centest mortar. But many houses are bakes but it midstel the coltar foor constate of to more than two incides of calciers covered by a very tills bettering it is cortain to be broken by the recept handling of sale-cain, the cellar floor should be sounded or touted with more haven joider such as the but and of a place of another to the cellar floor should be sounded to rested that could take could be subsolved to the cellar floor should be sounded to the cellar floor should be subsolved to the cella

well as the weight of the partitions above it. These in turn carry the taner ends of the second story joints, together with the lath, plaster and other heavy details. The support of this girder is highly important. the second story foliat, together with the second tory foliat, together with the first foliate and the shidler into his own tors gone up, the quality within ten peer a large within the peer that the peer peer the peer and the peer that the peer the peer that the peer th

IVEN honest mientoon we can build altogether better houses teday than hove ever been built. But we do not altways do it. The demand for a million homen has brought the speculative builder into his wom and as the price of materials and workmarkly here gone down. Within ten years a large number of the American people are due to discover that their jury-built homes are in process of rapid disabilition. It will be almost too lates to mend Yet those who today will gree particular altention to the structural fibress of the house they are being urged to bey rather than its suspressed appearance and modern equipment will feel that there wasterne on powering what they house and have too look for it—that is the kurden of Mr. Ingalli' article, and of the drawing an page 77.—THE EDITOR. "blow-of the-eye" value in giving a mis-estimate of the real worth of the structure The salesman knows that if he succeeds in auking a strong impression on the wife, she will work continually to overcome the objec-tions of the husband and may finally succeed in wear-

ing them down and out.

The temptation of the builder to pare down costs to

the desinent of a house, begins with the foundation. The founda-tion wall should have a proper foot-ing, for of itself it is not broad tion well should have a proper footing, for of itself it is not break
the proper of the weight over
the control of the weight over
the control of the weight over
the control of the case of a light structure such as a con-story break on sold
rock, or in the case of a light structure and as a con-story break on sold
rock, or in the case of a light structure and the control princip is not be
train of troubles in the weigh, for it
distorts the break. This extens to
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and baseboards, as well , so present the done
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Acceptable 1888.

And the problems of the 18 to 18 section, not 2 by 8. The excretion is a distinguish through circuit by the use of the secretion is a distinguish through circuit by the ten as of the section of timber, because the section of the circuit because the first of the circuit because the places for a solidary built house will agree will be a section of the circuit because the places where an increase of two or three people is included a special in include a section of the circuit because the places where the circuit because of two or three people is the circuit because of the circuit because of the circuit because of the circuit because of the circuit because the circuit to the circuit because the circuit

Any portions of a house are attached to it in a manwhich are at

heavy, men are matter how good to forching it is ago to section to some which are attached to it in a man-to-term of the respice, will also settin, in the control of the respice, will also settin, in the control of the respice, will also settin, in control of the respice, will also settin, in control of the respice of the serve-bedient to pare down the equality of little things here and here and the respice of the properties of the respice of the properties of the respice of the properties of the respice of the

princition by saving labor, as well as to provide a partition that will survive the sale of the house All sorts of embetizates for sound partitions are being es-ployed and in many cases their weight is being carried on but a single Scorjoist. Where planter is applied to

on but a single floorjoist. Where piplasterboard on such poorly sup-ported partitions it is quite sure to crack along the outlines of the in dividual sections.

dividual sections

Some of the substitutes which are
being employed to take the place of
sheathing on the outside of thi
house are very faulty. The chief
purpose of sheathing is to give
rigidness against stresses in a diag
onal direction. But there can be
little rigidness in a diagonal direconal orection in these can be considered in the consideration of the con

ΥÍ NAILINE BLOCK

A shinety vaming through the senter of a house is always a great tempetation to the irrespondible bulder. How clots are only ton often rested on the chinney and nall-ing blooks on the chinney arrive hoof the footing. A chinney about a love is not of or und hordens because it has exough weight of itself to support. This point is

Putting the burden on the chimney

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within a short period of years because the raft

period of years because the rafters are too light too widely spaced and in certain cases are not even tied together either by the attic floor joists or by either by the attic floor joists or by collar beams. When the weight of such a roof is excited downward especially under a heavy mowfall the outer (r 1 wer en is of the rafters are pushed apart. But if they have been principly spiked to the ends of the flor joists this force cannot have any deforming effect on the rocf and the roof will energes and the root will not sag nor will the walls of the house he spreed spart This is an other one of the structural details which a salesman will not be so apt which a salesman will not be so apt to dwell upon as the less definite aspects of the general attractiveness and inner convenience. The builder who instats upon saving a few dol-lars is to blame

-and he knows full well the ef

den en the eldmany — and he knows for of such reliable to the control of the cont



Always be suspicious of diagonal eracks in walls no matter how new or how well bush a house may appear. Crasked walls indi cte settling foundations settling or weak in the control of the control of the control is sufficient framework and undersated hum-ber. Creat care should be given to the ex-mination of foundation walls

The meaning of cracked walls

Town BASSESSON PLOOR

mas settling or weak or and understand house of the water was only the wall paper, with and planter and plain Capbondring whose joints cannot be difference in evident in the coal billia.

progen to the size of the transcriber of the secondary in order consistently to apportion the size of the fitnber to apportion the size of the fitnber to the attender The atrength, for In provided the load is kept directly above its long said, is surprisingly great. And a single nail in the correct of the secondary of the secon

owing to the greater depth of the wood in a vertical direction, have more than twice the strength of the The old time builders knew little and time onliners give little about adequate protection against winter cold Building paper was not used A house with which the writer is well acquainted was built in 1856, by a builder for his own occu

A Readable Series of Monographs on the Departments of the Government

PRESIDENT TAFT said 'Never has this vast or-ganisation (the United States Government) been studied in detail as one piece of administrative mechan in the continue of the second of the continue of the continue

Rastman Arthur T Hadley and A Lawrence Lowell

81

The monographs each dealing with a different branch or bureau are all prepared according to a uni form plan are written in plain lan guage and are readable rather than dry They give the history of the service its functions its organisa tion the character of its plant the tion the character of its plant the laws regulating its operation its financial condition and a complete abbillography of sources of informa-tion bearing on the particular ser-vice under discussion. To the pub-lic" states the limitiute these lic" states the Institute these monographs will give that knowl monographs will give that knowi edge of the organisation and opera-tions of their Government which must be had if an enlightened pub-lic opinion is to be brought to bear upon the conduct of gove

cruch helify for they are quite in same for relative and directions which makes the relative and directions which makes the relative and directions which the same and are relative and directions which the same and are and and row newtices up the same and are and and row newtices are same and the same and are and and row newtices are same and the same and are and and row newtices are same and the same and are and and row newtices are same and the same and are and and are newtices are same and the same and are same and and the same and are same and the same an Monographs dealing with the Geo logical Survey the Reclamation Ser



Here is what good construction means with regard to flown and herde walls. Note the houry fother commented by bridging which makes for rigidity and distributes weight result. Then there is the sub-flown hist diagonally. Next the building paper which lespes sold ut and dead from working up through the flow from the other Trinally

A monument to waste—the trash burner at a southern

IN IDAITY newspapers and our printing presses generally are using up annually a wast amount of paper shock which from the control of the cont directly or indirectly, upon an abundance of pulpwood, wood pulp, and the finished paper made therefrom. The American Paper and Pulp Association emphasised

The American raper and rulp Association emphasised a short while ago that we have become increasingly dependent upon foreign forests in the last seventeen years for a big share of the wood pulp used by our paper mills, and this despite the augmented utilization Page 2011 and that feegite the augmented utilization of General two O.I. It seems that of the total consumption here of pulp in 1990, fully 85 per cent was imported pulpwood and wood pulp. In addition, we obscured during the same year from foreign sources 750,000 and on two-pulps utilized the same year from foreign sources 750,000 and on the pulps of the full pages of the full page 2011 and 1990 and 1990

The association declares "The cut-over forest lands of the eastern United States, under proper munagement, could be made to produce the needed wood belay in this project will pile up the eventual cost."
This wide-awake organusation pertinently asks. "Why

tion pertinently asks "Why not begin now?" The pur-pose of this article is to reveal some of the promising work that has been done in this direction and to show be turned into a gain of great economic moment. At the present time, the

naturated in the wood pulp is, for the most part, concentrated in the New England, the Middle Atlan-tic, and the Great Lakes tic, and the Great Lakes States, where formerly there were abundant local stands of spruce Now, how ever, the wood for these mills generally comes from afar, and there are plants tain their raw material from Canada, which large to pay around \$40 a ton the de-

The Paper of the Future Means, Ready to Hand, for Staving Off the Impending Famine in this Essential Material

By S. G. Roberts .

livered pulywood. At the point of shipping, the average price of that wood was apprecimently \$12 and the point of the poin pulp manufactu of \$116.405.720.

or \$110,000,720.

Down in the Southern States, where the long-leaf yellow into Southern States, where the long-leaf yellow into Southern, the forests are being attripped of their timber at the rate of nearly 4,000,000 acres annually. There are today more than \$0,000,000 acres of these demoded tracts in the Southland, and because of these demanded tracts in the Southhand, and because of the difficulties tundent to removing the stumps prob-ably not one-test for of these quentions forwards have been also that the state of these quentions for the state ductiveness of the sell is fully recognized. Moreover, when one of these reamous pines is fielded only about one-chird of the rise ever reaches the market at low one-chird of the tree ever reaches the market at low or targeting the pines for turpressines are killing years of targeting the pines for turpressines are killing years our salves with the residuous pines when realmost woods are utilized to but a unifore activat in the making of paper?

utilised to but a minor actient in the making of paper? Because lung-leaf yellow pines offer the means by which to decentralize our paper-making industry and which to decentralize our paper-making industry and our less public to the series of the public of the serveral beneficial processes for the pupils and of by-products of great value of the serveral beneficial processes for the pupils of wood, the salfate process is the one peculiarly mixed wood, the salfate process is the contract of the process which hids fair to dive economic importance to the high stump-dotted areas in the South which have not the high stump-dotted areas in the South which have not been supported by the salfate of support of the salfate process which high fair to give economic importance to the high stump-dotted areas in the South which have not been supported by the salfate process which should be supported by the salfate process which should be supported by the salfate process which are supported by the salfate process whi of charved or weather-blackened stumps. Latterly, this subject has engaged the attention of a group of New York Industrial segments, and their achievements both in full-steed plants and in a nuisature duplieste of a operations on an extensive scale. This is the outcome of substantially six pars of research
Hefore describing what Joseph II will allow the well to suncoints have made practicable, it might be well to

outline the paths previously pursued by inventive genius in approaching this problem of conservation. The first of these aimed to obtain tar, pitch, and charcoal from the stumps and the trash wood by subjecting them to destructive distillation, the value of these commodities being counted upon to offset in a neasure the cost of clearing the land. Since pine oils have become unevil in the flotation treatment of certain

interests, this utilisation of forest waste has proved moderately profitable. The next endeware was to tap the treasure hoose of vagetal riches by means of the so-called "steamenthe object process." The procedure constain in cutting colorat process. The procedure constain in cutting closed reasel under sufficient pressure to distill of the temperature—the residual wood, matter being afterwards dried and burned for fuel. This process became commercially worth while only when it was discovered that, resin could be extracted in paying quantities if the The third cases would primarily to put the offer the wood to service in the insantacture of palp and paper. The restonous nature of the raw matterial, how-

The third easy sought primarily to put its fiber of the wood to service in the neumetheres of pulp and paper. The resinous nature of the raw material, herein, offered as serious stimuling floot to this underway, offered as serious stimuling floot to the made of the serious stimuling floot to the material, herein to the said pulp methods commonly relied upon by the total the said pulp methods commonly relied upon by the total twas learned here that pulp mills in Sonadraka were perful good results with the saidness process when bandling wood continuing considerable process when bandling wood continuing considerable tory, in producing chemical fiber and paper from yellow pine waste. Mr Wallace and his collaborators have been been from yellow pine waste. Mr Wallace and his collaborators have been been facility of kinder are and perfund yellow pine waste. Mr Wallace and his collaborators and made a demonstrating commercial run in a Swedien tank, is large until was built in Mississippi at 1915.13, and it was possible there to turn out chosenical pulp and Explay. The Swedie is the Swedie in the Swedie into, and they have unitabilished in the Swith since, and they have unitable the swith since the swith

pulp and paper. While the three foregoing methods have proved con-mercially successful in varying degrees, still none of them recovers a large percentage of the total wealth latent in the old stumps and in the longing waste of the region under consideration. For the most part, the various processes have been operated independently of one another and with little regard to their economic correlation. In short, taking the business as a whole, it has backed smallly

correlation. In source, taking the braness as a worse, it has included the biblioty and the term of the constraint of the constraint of the production of pulp for page making, in destroyed whose the wood is subjected to destructive distillation or when it is treated by the estem-and-order process. For influential purposes, the ceiliness substances associated with it; indeed, the superiority of this fifter in the matters of strength and plaintity is especially notable. Therefore it is most desirable in expectally notable. Therefore it is most desirable analysism and interest. And now we come to the most heartening aspect of this whole to work the convolution of this works in tacterial. And now we come to the most heartening aspect of this whole to conditionally the coordinated and he which the coordinated and he which the coordinated min to which the colorest pike inands, wall

the ent-over pine lands, yal-ued at present at about \$8' au aere, can be made to give a net return of substantially 8000 per acre from the cus-bering stumps and wood areas available for farming or for other time. Again, Mr Wallace and his co-workers bar-

Jeui Livouga the medium of laboratory inclities; said is consequence of their flywagi-gations, begont in 1816, it is today geneticable in utilise every bit of the stump and logitus retale is an efficient-and profitable missasse. Breas-themed.



Cotton growing on southern land, formerly wasta feet from which the stamps that mosts it worthfeet have now been elegand. And the stamps can be made into paper!

ward appearance of dead wood, still beneath this cleak is a wealth of unimpaired fiber and an amazing amount of realisets matter Simmas ten, twenty, and thirty years old are, as a rule, substantially sound and expalse of yielding prime wood pulp and paying quantities of

Ny yieung prices wood pap and paying quantum or centled ayral stores. The new and coordinated system embraces the three ollowing outstanding activities 1. The manufacture of chemical fiber suitable for the aking of Kraft wrapping paper book paper, and test

2. The by-product manufacture of such naval stores as turputtine, pine oil, and resin 8 The destructive distillation of wood trash—un

as turpositions pine oil, and reads
as The descrively distillation of wood trash—on mitable for fines—for the purpose of producing acid control of the contr and varying physical qualities that might cover a con

siderable range. These uncertainties nave access
greatly to manufacturing
costs, and all too frequently
have meant the difference
between profit and loss

between prost and toss
We are assured that no
more complicated apparatus
is required than ordinarily
found in the run of saw tound in the run of saw mills and that the labor need be no more skilled. The application of the method involves only the perfor-mance of work along pre-scribed lines and the tur-pentine oil, and resin ex-tracted from the chips are of a superior grade. It foll tracted from the chips are of a superior grade. It follows of course, that the use of a standardised material for pulp usking insures a better product, and the ex-perts also claim that it is practicable to get an in creased yield. The marked effectiveness of the procedure employed in taking naval stores from the raw

chips is principally due to the action of a selective solvent. The nature of this, however has not yet been made public. Experience has proved that the inodest value of the low grade resinous naterial remaining in interest the selection of the low grade resinous naterial remaining in its removal in advance of publics. Buddee, this redin ous matter surves as fuel in the subequent recovery of the chemicals utilized in pulp making.

A survey of cut-over pibe lands in Texas for in part of the chemical properties piles of the chemical prop some of the colling o ngure does not include the value of the fact that must be burned to run the distillation plant ref the solvent obtained during on, single in the operative evels of the entire system. It is estimated that an outlay of \$30 per acre would cover the charge for clearing f e, \$15 for the land and \$15 for the material taken theresio for the man and \$17 for the material taken therefor in Appropriate this whole subject f a more economical employment of waste pine with it should be pointed out that sawmill refuse is plentiful throughout the Southern States and this raw shuff can be had for pulp making in well nigh unlimited quantities at \$150 a cord. Aside from this source of supply however there is enough workable material in the abandoned timber lands to keep the modern system going on a



The digester and diffuser employed in demonstrating on a laboratory scale, the practicability of making paper from the yallow-pine waston so plentiful in the southern states.



The ministure beating engine, a faithful duplicate of a requiar paper mill machine, which has bee employed in showing how the collulose of yellow-size stumps can be turned to a handsome profit

Schil-commortial extraction plant used in developing a prophys for the manufacture of high-grade abval obline in composition with the large-scale utilization of yellow-size water.

splendid scale for three or f n decades to come Further by replanting the cleated mass with vellow pine seedlings a second marketalla provide fit for

Farther by replanting the cleared man with vellow plue seedlings a second markind he away the for tunber and for pulping purpose, on he cunted upon in the course of 50 years. In I. na, heaf ping grows fully twice as fast as the northern square. A fast not generally realled is listed the suifact effect from vellow pine wood waste is by no means this lited to the making of wrapping cavelope and long papers not to maintain box and caroling cavelope and long papers not to maintain box and caroline to the man of the control of the control of the control of the following of the likes of fines products on a pook magazine, stationery, willing paper etc. II is authoritatively suited that in whitever directions designed authoritatively stated that in whotever directions chemical fiber now dominates the field because of its virtues there sulfate fiber from our southern pine waste will for the same reasons eventually hild sway while in all branches of papermaking where filer strength may be an important consideration this newer commodity will

na important consideration this naver commodity will contrain all of the competitors.

Finally by clearing off the cut-our pine lands in the manner described great areas will be made available for agricultural development and where tracts have been considered to the contraint of contraints of the contraint of the contraints o

Radiant Heat Versus a Gale
DURING the coldest days of the winter podestrians
Work were amost without exception caused to jump
stightly as they unexpectedly and suddenly came within

the invisible shaft of radians heat thrown out across the heat thrown out across the didewalk by a mammoth electric bowl heater made only for advertising purposes and using about fifteen times as much energy as the common bowl heater such as is often used to heat a bath-room on a cool morning One of the most remarkable things about this method of heating is that it is not an fected by any degree of wind the wind does not blow the heat away or to one side in the slightest degree. Moreover the heat passes through the intervenprocess through the interven-ing air and glass without heating it. These character istics set up a fine illustra-tion of the difference be-tween radiant heat and sen-sible heat which if exact ness is required are two sep-erate and different things which are given the same name. Is it not true then,

name. In it not true thee, that radiant heat and sensible heat are both forms of heat? Would they not both heat the hand that is brought to them? The truth is, both kinds give the same report to the human nerves. But the one sensible heat is the only one when we sense-organs capable of perceiving while the other radiant heat gives us report at all until it has implanted upon our skin where report at all until it has implanted upon our skin where the ether vibrati us which constitute radiant best set up molecular vibrations which are sensed as heat. What up molecular violations which are school as near water we then perceive is not the riginal heat at all but the effect of it translated into the same molecular vibra tions that occur in a piece of but from A but from can warm the air around it but the passage of radiant heat will not for it is not transmitted by the air but by the other like light it finds the air no obstruction When it stilkes an naque object however it stops nets its molecules into vibration that is, warms it and from this it is given up to the air as sensible heat of the sort to which we are accustomed

"Since the ether is in no way influenced by the wind the beam of radiant heat reaches out into the winter breeze passing through the window without heatin, it

irrese passing through the window without heatin, it except in a slight degree owing to the presence of in pulses in the glass.

In the glass, the property of the state of the presence of the pulses of the glass, and the glass of the glass, and the glass of the gla object were placed in line with the heat ray or be such as a piece of furniture the room would s

Our Point of View

Our First Psychic Tests

IIF REPORT on our May seances got into the July issue only by our taking a form off the press after printing had consumenced. The page currequoiding, to the present one how ever was so far advanced that delioral comment necessarily went over until now. Such cotament must take serged directions.

Adherents of the medium have described to us place monema obtained in their presents, which go far belyoned anything done for us and which if necurated respective would call either for genuine mediumahip or for or tendiv confederate. These muniformatics we have no cucnens with what the medium has done at other medium and the medium has done at other times and places and under other conditions time out all we need say and all we can say is that there was no eidene and under other conditions time to relieve and places of the planoment; in direction that they were medium to Camiltian concernative statement in the planoment; of the continue of the conditions concernative statement in the respective planoment of the conditions concernative statement in the respective planoment of the conditions concernative statement in the continue of the conditions concernative statement in the planoment, and the conditions concernative statement in the planoment, and the conditions are considered to the conditions of the conditions are conserved as a statement in the planoment of the conditions are conserved as a statement in the conditions are conserved as a statement in the planoment of the conditions are conserved as a statement in the conditions are conserved as a statement and conserved as a statement and conserved as a statement and

Our clertrial apparatus has not been questioned per are but dist this above nerviewed that its data can lead to so crafts rical a conclusion. Its sensitivity was used hera to with the a weight of size pounds in the meetims a chair was sufficient to keep the till tale immy a light. This due to the meedium a realizable and it should laugh out of court the suggestion that smooth ecoplasm was abstracted from the medium to bring, his weight below the setablished his second to the setablished his setablished that the medium weak in morpeit of trance should out that the medium weak in morpeit of trance should out by the country of the

humerous wise fulk of the offensively hard headed type have scoffed at the elaborate methods used. It is much simpler than that to trip a medium they say me needs only to flash a light. Replying surenstically we should exclaim. 'What a pity we did not think of Meeting these gentlemen on their own level that ! we should point out that after sitting in total darkness for an hour or more the flashing of an adequate light would leave one blind and confused for a time quit sufficient to enable anything suspicious to be covered up Making the simple statement that we had pr mised not to flush a light we should doubtless shoot far over the heads of these critics. But even so they must real ise the dictates of expedienc) Surely the way to establish our tenalty against the medium s is not to start from a broken pledge surely the way to get more the dimes to come forward is not to employ bar-room factics with the first applicant. If questioned why we ever made such a piedge the answer may be again on the ground of expediency—though we prefer to an swer by saving once more that we are not investigators of the sort who 'know before they start that the medium is a fraud and that if there be gen mediums there is very good reason for not flashing a light while they are at work. We hope it is settle that our investigation is a matter of science not of ilt ind batters, and that any medium may come before us with the expectation of proper and courteou

On grounds which we have already catalogued in rebuilted we have been criticated as unduly creduless. There has been the assumption that our reports would han toward the paythe vide, and the already to discount them in advance on this expectation. We keep the outcome of our first treets will have spiked this idea that we are createsed before we start and will have made it clear tight any faverable, report which we may reader will be based upon facts calling for such report on the other handfull prefetch believers must reating that our conditions and procedure were proper. Indeed, when aithing maker very wharp controls, the author when aithing maker very wharp controls, the author fet so free from restraint that the displayed some time partience to know when the lightwining-up process was to lead to the well and the proper frankly that in our view anylowdy who objects to the conditions of these seances as in any way inhibitive of the best action of the psychetic forces would before a distinct price of the process. The forces would before a distinct price of the process or any methods whatever that look toward the prevention or desection of fraud are inhibitive.

It should be reducibled it at we have not as with all solution to even with a medium or well reports the generally admirted to have produced supprising results under reasonably severe conditions. We have sat with a single medium and have had a very medicore performance not even up to the standard of high-grade fruid. Total districts made it a matter of some finese to demonstrate the tree nature but that is the best

Mr. Lasker on the Shipping Board

ILLA PREMIOD of two pears, tor which Mr Laker, at the request of President Harding screed to undertake the chairmanship of the highping Board and endeware to being order out of chaos having elapsed he announced his retirement and in a report to the President gives a concise sistement of what has been accomplished in Ma signatic that or airways and organisation

A gigantic task truly for not only was the investment of public funds darker that of any commercial enterepties in history but conceived as a war time effort and praiseworthy as such, it was an attempt to create a vast merchant martine by compressing into months the animal growth of generations and inevitably 'was focused to disaster.' Thus 'Ur Lanker tells us that the administration of the field was not remotely was a focused and animal growth of the same and an unrecorded residence of \$100,000.00 was only in a case countries grades worthy of the name existed and an unrecorded residence of \$100,000.00 war claims remutated to be settled to be or \$100,000.00 war claims remutated to be settled.

One of the seemingly smolvoble siteations confront ing the new Board was the 50 shipping companies, who had bought 154 ships at war-time prices and, because of an 50 per cent decilies in ship values, were bankrup or facing bankrupicy. After meants of study, the companies of the companies of the companies of the the American Sales. The Shipping Board has new 'the most complete and accurate accounting system in the covernment services,' and the Diversor of the Shipping recently stated that 'the Shipping Board is the only forerament among with a monthly prial balance,' By Tome 50 the Board had practically settled at 12 contable of the Board had practically settled at 12 conta-

The Emergency Fleet Corporation, charged with the commercial operation of the ships, has reduced the monthly defect of \$15,000.000 in \$4,000,000 is sheath, and has provided nearly two-more treight lines, girling arclicate service on every count trade count? Paissingle and traight ships styling the American San have brought the United States size days close to Storat Assistings.

and in the Pacific are rapidly expanding trade spinifigue with the Orient. It is believed that with the entry of the "Levistan" into service we shall make rigid geopress in the North Atlantic, where the compétition, is

On taking office, the Chairman promised to office; a policy which might prove the heat of a premission merchant marriae. On this cores left Leafer eduplishment and the control of the core left Leafer eduplishment and the control of the core of the core and the control of the core o

chant markes in the event of war fo Mr. I have been a consistent of the possible by the Pises Corporation of twelve to sighteen absoluture operations, whose sensest policies it shall control. This centrol should be with a view to utilizate use to greate owners. Such a scheme will call for 200 slope of 200,000 deadweight tons. This will have 100 serples slope many of which are inspectable and should bricken up. Of the balance, 200 ships of 1,700 000 tens deadweight thould be selected as a reserve. The above vanuals plus our countries only in would give us a next countrie of 7,000,000 tens deadweight; a sortal which would place us in second position among the martitions powers.

The Demand for Av Laws

URENG the year 1020 there were 154 alrojouse support of contents involving 60 shalleties, and 150 shalleties and 150 shalleties. All manages of the content of the content of the content of the Amazeta of the record by the Amazeta of the record by the Amazeta of Commerce, and an analysis of the record by the Amazeta of Commerce, around a tensus and the annual report to the Benericary of Commerce, strongly attenues the fact that, if casualties are to be regiment to the Covernment much provide are laws and exceeds jurisdiction over all civil flying Just why civil flying in specified will be obvious from the following facts in specified will be obvious from the following facts.

In 1024 approximately 1300 derillan sirylatase were in operation in this country and horseen 500 and 600 were owned by individuals and expanisations who present fixed beases and practical conservative by physics possible. An equal number were distributed anessign policies. An equal number were distributed anessign policies. An equal number were distributed anessign and extra hasterious aneignments. In view of these facts, we are not susprised to learn that during the materials and extra hasterious aneignments. In view of these facts, we are not susprised to learn that durings the part there were 128 accelegate same in the during the part there were 128 accelegate also gain and facts. An extra source of the part of the second section of the section of the section of the second section of the section

determ dit einer sterren.
The nearth of at this fir the argument of time with the First nearth of at this fir the argument of time with the Fueleyst temperature. Your after pair one disappointed have been propelly to good leady on the medicality of tage and the diplomage of pilots, was, any paor for both they have been importantly good only things they prove the nation. It is not this thirt their is a supposing and measurement lime of these thins the or supposing the measurement.



Our Point of View

tragedies district the public mind and prevent peop from investing in a system of transportation which they group before to be not yet made and practicable. No thoughtful partor who onstemplates the achievements in aviation can doubt that it is destined to prove as serviceable in peace as it did in the World War, but its extensive conspectful development will never be assured until-Constract is aroused from its present in difference. This awakening will come just as soon as onstituents bring pressure to bear upon their representatives to pain the greatly needed legislation.

Does Railroad Electrification Pay?

HE QUESTION as to whether the change from steam to electric traction on steam relivones results in a net profit, in difficult to snewer. Many notable substitutions of this kind have been made on our main railroad systems, the first great venture of the kind being the elecation of the four-track system of the New Haven Railroad between New York and New Haven. It is true that in the total length of line thus converted there are others which surpass it, notably the electrified mountain division of the Chicago, Milwaukee and St mountain division of the Chicago, Milwankee and sit Paul Railrood. The pressimence of the New Hawan electrication is due to the fact that it covers a four-track main lines which carries an activenely heavy pas-suager traffic, probably the heaviest of its kind in the world, to say nething of its heavy freight traffic. The work included the service into and out of the New York terminal, with the immense amount of switching and the multiplied train movements, both passenger and freight, which are involved in a great terminal of this

The electrification of the New Haven system was forced upon the company by the legislative domand that they should shollsh steam traction at the New York that they mode amount seems traction at the rew locks terminal, and the change was reparted in ratifroid centers as a more or law doubtful experiment on a wast reale. The original installation covering the 83 miles from New York to Stamford, Conn., was followed by extension of the electrication to New Haven, and then the complete electric operation of the heavy freight traffic. Naturally, the sugmesting world has availed with no little interest the publication of the relative nomy of steam and electric traction, developed on this great scale. The results have recently been made public in an article by Skinay Withington, electrical engineer of the New Haven System, in an article pub-lished in the Relicop Review, in which the writer emphasises the fact that while the "direct" savings can be accurately tabulated and make an excellent abowing. they will not in themselves usually justify electrifica-tion—this because of the heavy overhead charges due to the high first cost and other considerations,

On the score of direct savings due to reduced fuel colassispiton and molive power maintenance, we are told that, even after allowing for recent decrease in steam jacquestive coal consumption, due to the use of superheated steam and other haptovements, the annual saving in feel due to electric operation is shout 200,000 tons of deal per year. The significance of this result will be apprietated when we learn that the electrified rolling stock includes 108 electric locomotives and 79 consists and accesses, as whether discharges designed consists and the consists of the consist de-unit cars' with an annual mileage of 4,928,000

for a number of years. And the credit for the saving in the cost of such construction must be granted to trification Furthermore, the passenger tracks at the Grand Central are on two levels something which would be impossible under steam operation. Therefore electrification must be credited with having reduced the necessary terminal area, which under steam operation would have to be twice what it now is. Also most important is the fact that the area above the present terminal is available for commercial buildings, and the revenues from this source we are told if capitalized, amount to more than the entire cost of installation in both the New York Central and New Haven electric zones. This, of course, is a special local condition and will never apply in the electrification of stretches of main line which include no great city terminal

Saving 160,000,000 Tons of Coal

E HAVE no economical problem confronting the United States today that makes a more insistent demand for close attention than The annual consumption of coal and oil is increasing so fast as to lay heavy emphasis upon the prediction, so frequently made in these days by competent authori ties, that the exhaustion of our fuel supplies is being brought within measurable distance. Hence, it is an imperative duty laid upon all large users of fuel, both to practice economy in its consumption and to utilize every source of fuelloss power that can be rendered available. Preeminant among these is water power, of which the great rivers, streams and lakes of this country afford vast potential supply

Of the many proposals which have been con and worked out on a practicable basis, the most am bitious and most carefully elaborated is that known as the super-power zone, which comprises the territory extending from Boston to Washington, and reaches inland from the coast for a distance of 150 mile Speaking of this project, Mr William S. Murray, chairman of the Super-Power Survey Commission of the United States Geological Survey, recently said "If the electric utilities within this zone were to meet the future load requirements by extending their power facilities jointly in the construction of large hydro electric and steam-electric plants they would save yearly 50,000,000 tons of coal." He based this statement on the fact that the average fuel consumption of these utilities during 1919 was 2.76 pounds per kilowatt hour, and that if we were to include the coal rate for the railroads and the industries, this would mean that such a figure would be changed to not less than four pounds of coal per horsepower hour

We have made wonderful strides in the developer and use of electric power, but Mr Murray points out that the last and greatly needed stage of electric utility expansion is still about of ny. He believes that nittmately the separate electric utilities will go out of the ower production business, and that they will receive wholesale electric energy from certain great power companies. These compazies will be entirely outside of the corporate existence of the various electric utility companies, whose function, thenceforth, will be to dis tribute energy, so received, to the customers within their franchised territorial limits

The super-power some scheme involves of course a large dependence upon the hydro-electric possibilities of the Niagara and St. Lawrence Rivers, and in the close of his address at the recent commencement of Lehigh University Mr Murray gave in some details his calculations of the amount of power which is run ning to waste on these rivers. Translating his totals into terms of coal consumption, he finds the utilisation of these rivers would after a saving of about 100,000,000 tons of coal annually.

The Screenist Animacan is an ardeat believer in the ments of the super-power some scheme, and in the eco-possic stillustion of the immense reservoir of potential energy with which nature has enriched the United States on its northeastern borders. We say this with full consciousness of the sacrifice which would be in voiced of the speciacular features of the Magara Biver, but, in view of the rapid increase of our population with its enormous future consumption of fuel, we feel that this at least is one instance where sentimental considerations must ultimately bow to the stern demands of utility

A Great American Venture

HE PLACING of the "Levinthan" on the trans Atlantic route in competition with the long established foreign lines is the greatest single venture on the high seas in the history of the American Merchant Marine. It is a novel and trying experience, for, although we have run and are now ru ning some pretty big ships in the trans-Atlantic passonger service, not one of them is comparable either in size or in complexity to the "Levisthan" There are critics who claim that only the older companies, with ample experience and a large trained staff to call upon, can place a ship on this route and run her sufrom the very day she enters upon active service. We all know the old saying "Give a dog a bad name", and if the "Levinthan" had started on her first voyage with a crew of between 1200 and 1300 men, unacqualated either with one another or with their officers or with the ship, and difficulties had developed in the engin room, on deck, or in the service of the passengers, there would have been a chorus of "I told you so's" from the sceptics, and the prestige of this great ship would have suffered a blow from which it might never have

The situation is well understood by shipping me The foreign services, particularly the British companies, have always made it a point to run trial trips, with a large number of guests, for the purpose of "shaking down" a new vessel, not merely as regards her engine room and crow, but also in the dining room stateroom and social service. Extended trial trips of this char acter were taken by both the "Lushtania 'Mauretania '

The "Levinthan" is much more than just a big ship. She is a gigantic steam power plant, equal in capacity to the large generating stations which furnish power to drive the subways and elevated systems of this city She is an electric light and power station, with a plant sufficient to light a town of considerable dimen She is a large pumping station, whose machiners handles an amount of water which would suffee for the perds of a city, and lastly she is a first-class hotel matching in her luxurious accommodations and her capacity fo guests the very finest of our far-famed American hotels It would be the very height of folly to throw together this great aggregate of men and machinery and expect it to function smoothly without preliminary tests and training. Hence it came about that just as the Government sent the "Leviathan" on a five-day trial trip after reconditioning for the transport of troops, so now it has subjected her to a similar five-day trial after her elaborate reconstruction and reconditioning us a first class trans-Atlantic liner

The 'Levisthan," as we have said, is a great Amer ican venture. Into the work of reconditioning has been put all the experience of the past and many new features which, as we have shown in the article elsewhere in this issue, are designed to render her the safest and most comfortable liner atlant. The men who have done this work, engineers, contractors, draftsmen and even the working men at the pards, have regarded their task as something in the light of a sporting proposition, and we have reasons to know that hundreds of them have worked long hours of overtime without pay, believing that here was a chance to show that what we did 75 years ago, when the little schooner yacht "American won out at Cowes, we can repent with the "Leviathan" upon the trans-Atlantic course

Our Psychic Investigation in Europe — IV

A Sitting with Evan Powell, the Well-Known Welsh Medium, that Was Very Rich in Phenomena

By J Malcolm Burd

Associate Editor Scientific American, and Secretary of the Scientific American Psychic Investigation Committee

ITTIOU T may quantion the bees seamer that the fine Singleind was that of Monday March 12 with Mr Brun Powel! Indeed, March 12 with Mr Brun Powel! Indeed that the Mr Brun Powel! Indeed that such a first the Mr Brun Powel! Indeed that such Mr Brun Harde affect he also decurred hat to bet that he had never seen such a settlement of the Mr Brun Powel Mr ITIIOI T any question the best seance that toire as that with which we had just been favored There were many things d ne for which I could not con

ceive a rational explanation on graunds of fraud

Mr Powell was originally a Welsh coal miner he has now progressed to the dignit; of a coal merchant dein, a small local business Ills quariers is down in Waks he runs up to London once or twice a month to give sittings at the British College of Paychic Science for these he refuses to accept a penny more than his actual peany more than his actual traveling expenses. The Col-lege gets more than that for them—a guines or thirt; shill ings or some such fee from each sitter the profit going into the general funds of the College

This medium is not one of those sensitive shrinking souls who are so easily thrown off their psychic stride It is his custom to sit securely roped into his chair-or at least to

into the chairment at the chairment and an appearance set urely roped and he states that he has become so actuationed to this that he is more comfortable and produces more and better results when bound than when free He reminds you without waiting for you to broach the subject that the phenomena commence of insurance unless the letters can are of no interest or importance unless the sitters can are of no interest or importance unless the states do not not to state of the satisfied that no fraud has been committed and if you omit any of the elementary precautions he insist that you go back and remedy the oversight. Either he is a geouine medium or powersed of unlimited con

The 'control another American Indian named Black Hawk has the same viewpoint and h. will not volun staws has the same viewpoint and it will not visual tarfly permit one part of the program to be passed for the next number without having assured himself by repetition if necessar; that all the sitters have need or heard and that all have expressed satisfaction with the particular phonoms non in question. Black Hawk drugs the words fraud and cellective balluchation. right out into the open during the senuce and insists bilities have been eliminated the seance is without value. Several times a light or a voice or a physical contact was repeated for the benefit of some sitter who value Several times a light of a voice or a physical contact was repeated for the benefit of some sitter who had not been suie that it had happened and more than once after a particularly powerful demonstration the sitting was held up while Black Hawk got us all to agree that it couldn't possibly have been collective hallucination. He was very bitter and very sarcastic

ullucination where the explanation is a superior with the explanation in the arrived together and were taken in a first the unper rooms where the medium was have the unper rooms where the medium was have the control of the unper rooms. to one of the upper rooms where the medium was having a nap. He had journeyed from his home to Crow borough the day befure to give a private stiting at Sit Arthur s house. This had been a brilliant success—so much so that 'il'r Arthur feared it might have drained

muce no that 'sir Arthur Feared it might have drained the medium to the deriment of Monday seemer. The fear turned out to be, groundless We woke Mr Powell who explained that the nap was his custom and not at all a result of Sunday's was in cluston and in a first a count of success of nervous anticipation the most trying feature of the whole performance, affecting his abdominal regions very unpleasantly affecting his abdowlinat regions very unpleasantly— presumably through the selar plexus nerve-center, and whenever he can, he sleeps through this.

whenever he can, he seem strough that he was prepared to force me if necessary to take what he regarded as due precutions against frand. He stripped to his under-

surments and insisted that I search thoroughly all his parkets and examine his clothes with full cars in other respects and that I assure myself that the undergar rants contained only himself. I was able to find noth July contained only himself I was also to man note in , except his actual garments plus a handkerchief Ibin he made me go with him to the wash room while I washed his hands in het waste to prove that he had no luminous substanc. on them, after which he demanded that I stick to him like a leoch until we actually went into the scance room Amin I remark that he is necessarily tenuine or possessed of unlimited and of course

if he were fairly sure that he had something that ordinary ex amination would not disclos the invistence upon such ex amination would be the logical thing to distract the attention of the investigator I always of the investigator I always add in as slipshod a fashion as possible the things that I was asked to do and devoted as much thought as I could to things that were not thus any greated In Powill's case I found absolutely nothing suspickus before the seance.

I or the business of tying the medium is his chair a sincle

medium in his chair a single ing rope was provided and it was insisted that I do the tying with the cooperation of with the cooperation of an other sitter who was much the same sort of outsider as I—a clergyman anxious to see for himself what there was in the

with Evan Powell, the celebrated The back of the medium s
chair was brought hard against one of the columns of the cabinet and the chair was securely tied in this position. The medium then took his seat and the reverend gentleman and I tied him in as well as we knew how He was tied to the chair by ropes about his theat and abdomen his upper arms were fied to the diagonal segments of the chair arms and his wrists diagonal segments or the chair arms and his wrists to the horizontal ends of these members and his legs were tied to the chair legs. Finally the two ends of the rope were brought together beneath the chair and scaled with wax. Aside from this point the only aug gestions as to method which we received from Mr Powell consisted in his repeated

rowel consisted in his repeated urging that we draw the ropes tighter—we finally gut them much tighter than we should have dared draw them if left to our own judgment as to

A The medium B Mi Bird C The sirrgraman D F The table at the businning and red of the stating respectively E C The was of Slowers stating respectively E C The was of Slowers the Slower than 100 miles of the sirrle when the Right was restor! The single crosson man't the position of the two clusters of bells at the heginning the double crosses show where they were found at the end double crosses show where they were found at the end

Diagram of Mr Bird's sitting of March 12

circulation
On general principles, one is
suspicious of a tie made by
passing a single length of rops
many, times about the body,
aims and legs There always
is the feeling that by playing
the slack—some of which al circulation

is the revellag that by playing the the electacement of which at incommon the control of the con

And yet there was one feature that was profoundly manifestion." Beerpfork more that when a last is teld in ordinary newfag cutton, it cannot be unted the thread must be broken. As a final step in the typing the needlums a thumbs were tied together as they stop annexed to opposite arms of the chirt, by an 110 min length of thread, tied very lightly about the base of each tunnib and down trust arcsue the space between each thumb and drawn tast acrose the space between them Obviously, as long as this thread remained in tort be rould not be any physical possibility slip his control of the state of the state of the state of the vastly hampered by the presence of the thread it than the thread were found unbrooken at the end of the sounce, there would be but three possibilities to con-sider that the medium had remained teld throughout the thread had been broken and replaced. A fourth attendable presented by the possibility that the thread might be broken, and remain so. The second of these alternatives is any repeated to The second of these alternatives is any repeated to

discard the medium could no more have made a series of ties that would have looked like mine, than a com of the that would have looked like mine, than a com-putent curpenter could initiate a house that I might build invaeld. The third alternative could apparently have been effected only with the aid of a confederate the medium had no thread if my search of his garments and person was an adequate one. Moreover when we came to remove the thread from the bases of his thumbs at the end it was so tight that we could not even get under it to break it we had to slip the point of a pan uncer it to break it we had to slip the point of a pan knife under it and cut it. My best judgment would be that it was just as tight as this at the beginning and that even it we waive the question of where the medium could get fresh thread and what he could do with the old thread he could hardly have carried out this sub-witinition.

witution This brings us at the same time to the fourth alternative and to the one suspicious hitch in the sphoin proceedings. At the end of the seames, one of the best of the seames, one of the seames, one of the seames, one of the seames of the sea This brings us at the same time to the fourth site

was intact I should have realised the unwisdom of this request and refused to comply with it As things lay, I real with it As things lay, I real ised it the moment after I had broken the thread—but then it was too late. The thread re-sisted my pull for an instant,

in over to distinguish our control of the The thread related my pull for an instant, and then came away and for a month of the to report in the temperature of the months of the distinction of the months of the temperature of the months of the

JIF the appearance in our july issue of the story of our first formal seances, it becomes more necessary than over to distinguish between these serious exemptic ustings and Mr Bird's informal examination of European mediumship This month we have nothing further to report in the we have nothing further to report in the way of serious investigation, so Mr. Bue's story of his European expenses encor must stand alone It may not be out of order, therefore, to repeat that is trip has no connection with our in-vestigation here, serve as the experience found any suffect procedure to be adopted in our American work—THE Forces.

A Giant Among Gigan-tic Wind Tunnels

The strange h ra like b cover picture of this home is the huge nero dynamic or wind tunnel recently con wine tunner recents con-structed by the neronautical engineers of the French arriv I Isos les Moulineaux just outside f Paris. It is just outside f Paris It is lart f the magnificant equipment of a large zero dynamical testing plant which occupies extensive buildings and plants and which is intended to keep France well in the forefront in the matter of aviation

The great wind tunnel is built of reinforced concrete and occupies an entire build ing of its own It is a somewhat complicated structure

what complicated structure on the instale where the module of airplanes and airplane parts are tested in module of airplanes and airplane parts are tested in the strong reals of air. The tunnel measures 110 freet in length At the frost read is a faring member which is elegated to flow in air by memon of a powerful fan month of the tunnel is about eight freet in diameter while just back of this conses the square-shaped body the interior of which forms a good sized testing channel beautiful to the structural from frame which serves to hold the small models in the swiftly moving current of air. The clambre also con swiftly moving current of air. The clambre also con the sire current pressures, angles of planes, lifting force and so on

By means of the excellent facilities provided by this

By means of the excellent facilities provided by this tunnel it will be possible to determine with extract tunnel it will be possible to determine with extract security the performance of any proposed plane or any parts to be used in connection with aircraft Behind the ferting chamber of this wind tunnel there is a long tunnels some 10 fet in disaster which extend of the tunnels the special proposed by the extract the second of the tunnel is the great air fan driven by an electric motor. The fan provides for a maximum speed of air curvent of some 360 feet per accord. As a general rule however the special below this maximum and in synthieted by uname of the electric motor the proposed of the second se This wind tunnel has been constructed after the esign of the famous engineer Gustave Riffel

A Model Railway in the Workaday World

THE Rekdale Bailway
Said to be the smallest public railway in the world presents features of great novelty and interest. At first signt it is difficult to regard it seriously and our lilustra-tion will inevitably provoke a smile Novertheless it is not a toy or model but is of not a toy or model but is of real corumerial utility and as an engineering feet on a small scale it is unique. It is in fact the result of a rmarkable development of the model locomotive be-loved of most boys and in deed by many more adults than one might suppose Constructed in 1876 the

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tion was religiously of two
feet nike inch gage and was
used for the conveyance of
the village in Prédact to
Ravengiass on the coast of
Camberiand, where it joined
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serving a warful purpose
both as regards subneral and
passenger traffic for meany
joiner the mines at 2500
years the mines at 2500
valuant efforts to maintain it, the railway Raself sell into it, the rallway Reelf fell into



Front and rear views of the giant wind tunnel at Invy-les-Menlineaux, showing the flared gir intahe and the motor-driven section fan

and the moleculives succious fan sale in the moleculives succious fan sale 1912 in 1913 however a company known as Narrow Gang Enlivery Life, 'Ordained a beas of original rails, weighting 40 pointed a year being related for the time was those outpied with the biggest model becombives and rolling sinck in existence, constructed by Mesure. Basestic-Lowle. Left the wall known model becombives and rolling sinck in existence, constructed to the sale of the sale o

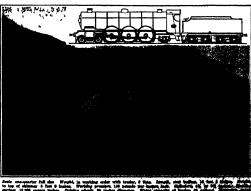
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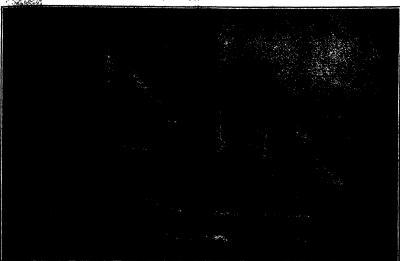
erroms and awnings are provided for protection in set or in hot weather. For winter traffic, closed logic concless are not that weigh 34 shunderweight; local could be as a single continuous and the set of the

capanie of come reasty usuau twenIntelligence Tweis and Immalgrants
In the Scientific Monkity for Novamber, Profuse
IN the Scientific Monkity for Novamber, Profuse
IN thinks I Young discusses the results of applying
intelligence texts to various immigrant groups to Assert
Intelligence texts to various immigrant groups to Assert
the highest preventage of finningstats cane from the
British lides and northern and western Burops, or pacut years a complete champs has taken place the highmout years and the property of the preventage
Europe This change, be considers, is of the greatest
importance for the practice.

commorrs, is of the greatest importance for the future of America. If the more recess additions to America are of a less intelligent stock then the consequences will be seen our for the future. In order to fast treatilement, then to test intelligence, the writer used the already well-known American Army tests, modified to soft the children he was testing and he also considered the work of others studying rachal difof others studying rachi dis-forences by like methods. As a result of a wary carsett study be brings forward evi-dance to show that the second of these contests. European atoms to very putch force than that of the chief stocks. If that is no, that the continued district of the original, more study!



me," built by Ban



Heavy weather in the Atlantic race. The American yacht is carrying a storm trysall on her mainmast; the British competitor has a reef in all three sails

The Trans-Atlantic Race

In this Test of Skippers and Sail Plans the Two Hulls are Identical

THE HAND TO A CONTINUE TO THE MEAN THE

the free supply is exhausted. The original proposal was to sail the race with only the shiper about, but was realized that the pleasure of the race would be that seed years. It was realized that the post of the race would be that seed yealst should entry a crew of two men. The sail plan of the American best shows that she carries a jib, a gast foresail, and a jib-buddel, level and a jib-buddel, seed a jib a gast foresail, and a jib-buddel, seed a jib-buddel sha have come into great frave of last years, not mereby in small yealth such as these, but in the large exact, each in the large exact, each only by the fact that a request was made by life Thomas Lipson that he be per Mr. White who has a grave in deep-need cruiting. mitted to use this type of mainsail on "Shamrock IV"

Mr Nutting, who is an expect in deep-sea cruising

can be manged down in bud weather. It is not unlike the year of a which is no youther in America, with
the difference tent the miscan based, instead of being
stepped at the extreme after end of the boat, is
brought forward well inhourd and carries a much larger
mill than the unisson in the yaw! It is needless to say
that in rigging foot yarchie worthing has been done
to the say of the say of the say of the say of the say of
the say of appears in private or any of the say of
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is small yachts, has the to say in speaking about the respective motits of glo-headed and gatheaded sails. They pinkelsize points to the fact that the plant of the pinkelsize points to the fact that the plant of the pinkelsize points and the pinkelsize points of the wind "The latch right is known by the pintink because of its excellent pinkelsize points of the wind." The latch right is known by the pintink because of its excellent pinkelsize and the pages with which the latch type believes and the pages with which the latch type

dumage. The excitat, although small, as gar change in allow a man to get down out of the wind.

Helwor deck there are four rule-tae berths, and intered of fitten these with the same of the single properties. The same of the single properties the flexibility of a harmonck and is a suferguard against attention has been paid to placing error/tink particular and fro. Our drawing shows the two vessels enoughed down in heavy weather. The American hout is carrying a tone-frowed rysail to her mainmant, with a single seef in the jib and breeast. The littlink craft is carrying a reef in all three sails.

Summer Time and Radio

Recent Developments in Radio Broadcasting that Challenge Warm Weather Handicaps

By George V Haskell

ADIO broadcasting is now on a full time-basis Or to put it another way this is under summer. Thousands upon thou sends who les same radio fames during a ken interest in radio sepse tally during vacation days. Hadir receivin, seat are still

authen with the control of the contr noises of space are called then too the average receiving set reaches out to the remotest points in an astounding manner

remotest points in an actionizing manner as compared with the very much curtailed range during warm weather. Winter time reception of speech or mude is a clear us a cristal—charry by a good deal than the usual telephone line. Indeed the crystal-clear atmosphere of the winter is as transparent to radio waves as it is

is as transparent t; radio waves as 11.8 to the sight when viewing distant objects. But with the approach of warm weather the atmosphere is no longer as timagarent as it has been during cold weather. It becomes trained it loss much of its transparency receiving ranges are cut down radio. to leplicae icception is blurred and distorted extrane-cus neises gr w in number and in v lume Radio programs are apt to be broken up in the most aggravat

Again warm weather is cutdor weather Again warm weather is cutdor's wather interest-fore the radio receiving, set has been a rather cumber some installation calling for various pieces of bulky and delicate apparatus particularly a heavy and messas storage latters which did not lead themselves to read;



Typical pertable regelving set making use of dry battery tubes and Rollo-frequency amplification

transportation. The consequence has been that realists has been been the the thouse when he were an Assertion sought the outdoor life of summer time and reaction sought the outdoor life of summer time and reaction. Again these has been a term few of lightning and the supposed dee haster introduced in consection that the supposed deep haster in the summer of such section of the summer of such section of the summer of such section of the summer of 1902. The roomer radio of the summer of 1902. The roomer radio

arm weather
It was so in the summer of 1922. The young radio



Vacuum tube family, ranging from the tiny dry battery receiving tube to the giant transmitting tubes

industry encountered a serious slump with the approach industry excountered a serious stump with the approach of varue weather. The preceding springs and whater unrived the result beginning of redio broadcasting. The property of the property of

Then with little if any warnin, the bottom fell out of the radio business. The public stopped buying with the approach of warm weather. The stores could not the approach of warm sendier. The stores could not move their goods. The manufactures to their intense dismay found many of their orders cancelled and the mars flow of quantity production suddent's backing up a first production of their orders and the store of prices such as no other business has ever witnessed in many uninformed quantries it was freely predicted that the radio infrastry was a newelage 'crosse' and that limit in other order. But to the better informed this state of affairs was simply a marked slowing up of the radio industry during a warm weather due to serious less of foreign the other part of engineers and reas facts of foreign the other part of engineers and reas facts of foreign the other part of engineers and can be a support to the radio foreign the provide for the radio foreign all the to provide for the radio foreign of summar.

The decline in radio enthusiasm de

of animals in radio enthudism during the summer of 1922 may be attributed to frarty, failure on the part of the radio industry, both from an engineering and business standpoint to meet summer-time conditions and the standpoint of the radio industry and prevailing free of lightning thirdly, interchemon from static and the general lowering of radio efficiency. But typoses are bryoness and the reads industry. But typoses are bryoness and the reads industry, but put has had sufficient foresistic, even during the brists business months, to both forward to the cutting the brists business months, to both forward to the cutting the brists business months, to both forward to the cutting the brists business months, to both forwards to the typosite of the fail business months, to both forwards to the present the part of t

ailments of radio. Today there are a eight nundred broadcasting stations in regulation, blanketing every copine of this wast our compared with 150 or so during the summer The consequence is that emplody, anywhere, wind of set, is reasonably sure of nearby broadwards of the consequence in the secondary to circuit several to the secondary the secondary to the secondary the secondary to the second

together with all the static and other innerrers which cope along with weak signals. Brow stations today are powerful as interesting to they serve nearby receiving so signals are sufficiently strong to with all noises of space excep-produced by a local thunderstorm, burden of overcoming summer-tim produced by a local thunderstorm. So the burden of overcoming summer-time radio ills has been tackied by the broadcasters to a large extent, which is as it should be The logical starting point in tackling static is to produce powerful radio waves which can be intercepted by relatively insensitive receiving sets—sets that are fairly immune to most parasitic disturb-native.

and the control of th If one is entirted with the nearly radi

ear phones exclusively temporarily doing away with the loud speaker

As far as lightning is concerned there is little to fear

just became one happens to have a radio receiving set The needble dangers of lightning have been ground rise present unique of lighting have been ground evaggerated by the press, in many instances quite un consciously at the very time the press was actually



trying to reason's resido laymen that there was no real danger if the precurtions were taken With the several million receiving sots now in opera-tion, there has been so increase in lightning damage, for the defice hand, there is no very in which importy protection, brought should by the proper promotion of the contraction of the property of the contraction of the state of the contraction of the contraction of the state of the contraction of the contraction of the state of the contraction of the contraction of the contraction of the state of the contraction of the contraction of the contraction of the state of the contraction of the contraction of the contraction of the state of the contraction of the contraction of the contraction of the state of the contraction of the contraction of the contraction of the state of the contraction of the contraction of the contraction of the state of the contraction of the contraction of the contraction of the state of the contraction of the contraction of the contraction of the state of the contraction of the contraction of the contraction of the state of the contraction of the co being considered in localities subject to severe thunder-terms, about the taken as reconsumedation for a radio receiving set with a high, incar and properly produced codes with specifications are provided to the produced codes with specifications are proved by the Na-tional Board of Fire Underwriters, are simple and effective, and when cose completed with there should be no further fear from lightning insurance, the produced of the control of the control of the con-trol of the produced of the control are to the con-trol of the produced of the control of the area of the control of the control of the control of the control of the area of the control of the control of the control of the control of the area of the control of the co

affecting radio audibility. Static frequency and static audibility are the other two disconcerting forces that may interrupt the reception of grand opera or break may mercupt no recognize to grant operator to necessary the continuity of market reports by radio telephony. A series of experiments, cooperatively engineered by the Weather Bureau of the United States Department of Agriculture, and the Nebrusku Wesley un University, of Agriculture, and the Neirradus Westip am University, have been productive of cent unions that tred to it troduce the questions. "Can radio messages be heard in a timedrecule of the control of the co outstanding factors as affecting the clearness of radio reception These, in the order named by M P Brunig of the Nebraska Wesleyan University, are (1) Static frequency, (2) nearness of thunderstorm area to re-ceiving station, (3) static audibility. However the atmospheric conditions at the radio transmitting point do not exert an influence on the audibility of messages do not exert an innuence on the audminity of messages at a distant point. For instance, a local thunderstorm in progress in Washington during the transmission of a radio communication from the powerful radio station of the United States Navy Department, would not mur the clear reception of the message in New York City The fluctuations of the barometer—or the instrument

vealing the weight or pressure of the atmosp -did not appear to influence the audibility of the radio pressure and the state of hearing of radio communica-tions is cause for skepticism on the part of the Weather Bureau of the United States Department of Agriculture, that radio instruments may be employed as a direct means of forecasting weather conditions. Attaching some credence to the theory aircady advanced to the effect that the use of radio direction finders and the audibility of static or atmospheric disturbences in the radio receiving apparatus are agencies for foreshadow. reggo receiving apparatus are agencies for forestation-ing the approach of storms, metoconlegists centend that the essential factors for forecasting are still lacking Howaver, the Bureau of Aeronautics of the United States Navy Department, in experiments covering a period of years, conducted at Pensecola, Florida, and

cialms that radio instru-ments have been effectively

ments have been effectively supplyed as weather value in foretelling the approach of hurricanes or violent thunderstorms that might prove disastrous to aviators. Be that mooted question set imay, the results of the tests of the Weather Bureau and the Notreaka Weeleyan University have evolved the contract which was tuned from the adversaria was come in adversariance on he adversariance can be adversariance. cast maps can be advantage-ously employed by radio transmitting stations to deine the handleaps or fa somble conditions in the environs of the various radio receiving stations. In these particular scientific observations it was determined that a thunderstorm raging in proximity to the radio telegraph and telephone trans-mitting station of the Navy Department at Radio or Ariington, Virginia, exercised no effect on the reception of

no enect on the reception of the Cohraska Wesleyan University, at University Place, Nebraska A radio telephone message originating at this station during a level thun derstorm was heard distinctly at a distant point where no colent atmospheric distinctors was in progress. The barometer credings and the mileage to the nearwest



Receiving set of the console cabinet type, with self-centained dry batteries

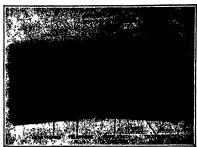
map of the United States for the corresponding twenty-

All of which boils down to the conclusion that thunorms do not interfere with radio reception to a merical at the market with the are in the immediate vicinity of the receiving station. Static does not hinder radio telephon, has one grant advantage over radio telephon, has one grant advantage over radio telephon and the static does not have respect telephon as one grant advantage over radio teleprophy. For instance, speech can be carried on

after a fashion in extremely noisy public assemblies. The ease in understanding speech under such circumstances is due to our life-long experience Then, too, there is what may be termed "assist-ance of context." By this is meant the ability of the average listener to fill in lost words which make sense to the entire sentence

the entire sentence
Since static and signal are
amplified alike, it would
seem advisable to suggest
less frequent use of the loudspeaker in favor of head speaker in invor or nead telephones, as already sug-gested, when intense static exists. Vacuum tube ampli-fication, especially a u d i o, chould be reduced to a mini mum consistent with signal

Reidom, if ever, is a program from a local station seriously interrupted by



Another form of portable receiving apparatus, which will receive with a few

static even when lightning flashes are plainty visible to the eye. The audibility of a signal required to oblit crate completely the normal static interference is less than 200 and local stations will be found to produce at least 500 times audibility with the

at least the stage receiver.

Under the old scheme of things—and anything over a year old as at to be termed "old" in such a young and progressive industry as radio—the equipment used for receiving over fairly long distances was quite cumbersome. The vacuum tubes—those little lamps which are the heart and the ears and whatnot of the usual radio receiving set—have been stendily developed. The first vacuum tubes employed in broadcasting reception required a six volt potential and somewhat over one

required a second potential and somewhat over one ampere of current for each tube. The heavy current drain even when using a single tube necessitated the use of a storage battery for the filament energy. In due course these first vacuum tubes gave way to others which made use of special conted filaments instead of the pinin tungsten wire, and which required somewhat less than one-quarter unpere for each tube One of these tubes operates on a single standard dra cell, and therefore lends itself to use in a portable receiving set

The latest type of economical vacuum tube requires somewhere between 3 and 4 wits and a current consump-tion of 46 ampere—or a trifle more than one-twentieth ampere A single tube of this kind will operate on impere A single time or time and win operate on three cells of flashlight lattery, and three tubes of this kind can be operated for a long period of time on three standard dry cells.

standard dry ceis.

The to these economical tubes, it is now possible to produce a receiving set which disposes with the former cumbersome storage battery and which, through the use of several tubes for amplification of signals, is of such extreme sensitiveness as to operate on any kind of a removing measurements in to operate on any kind of a tempority antenna, or even a small loop. There are now being produced several types of portable sets which are considerably smaller than a small sulcase. These sets are self-contained, with the filament and so-called

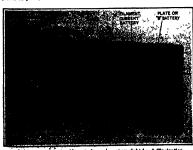
"B" or plate lattery neatly mounted in the case

The portable sets with their dry cells have taken
radio quite outside the home circle when occusion demands. This summer the radio enthusiast he hands. This militare the ratio cultimate take a exclus-for not taking his ratio set with him on his vacation trip, especially in view of the redoubled efforts of broadcasters to provide better entertainment features, more sporting events, better news service, and so on. The new wave length schedule, now in force, has also contributed materially to the betterment of broadcasting.

A German Motorist's "S. O. S."

THE stump in German currency necessitates the pay ment of many thousands of marks for motor cars One would be purchaser, however, has hopes of getting over this financial difficulty by the assistance of the British Automobile Association, which has received the

British Astonoblic Association, which has received in-following andre appeal: I come to you with a com-line group parks, Ric. However, and that I have not smooth money to hay one moriver I would be not smooth money to hay one moriver I would not be go send me some § I fryou will not I bey you do and your colleger that the circ me some §. I have one good motorcar to buy I was thankful to you if you despatich some a newty as I good.



Minter view of portable not shown in upper right-hand Mustration



This locometive, the heaviest in existence, with a tractive effort of 176,000 pounds, is one of the many powerful steam units which are to be replaced by a locometives with a tractive effort of 277,500 pounds

Another Forward Step in Electrification

How the Virginian Railway will Replace Steam with Electricity for Hauling Heavy Trains

HEN the late Henry H Rogers decided shartly before his death to use his cwn private fortune t build a railread of the highest standard in limmense enjacity through the coal fields of West Virginia

the upt the cost field of ever Virginian may people the upt that had begunt a slip. See see of active re sought to see that from the results of his city and the cost of the c R gers intellect ha I facked in thing of the keepins Within a very few years after operations were started in 1900 th Viz ginina Relivav began to make meet and it soon began to make records for even ings that are the eavy of almost even-ralifood in America. For example the ratio of its sperating expenses to gree exemings in 1922 was 63.44 whereas this same ratio for two other roads running through the same district were respec-

ively 75 27 and 79 2 There are three chief reamns for the success of this read. In the first place it obtains continually increasing traffic through which it runs Seconds it was constructed so as I keep oper ting ex pense at minimum with the I west grades

and the smallest number of curves that the character of the cuntry permits Finally it operates its tr ins in accordan system known as mass transportation which is un doubtedly the most examinating method under the exist

ing conditions.

By mass transportation is meant the handling of the traffic by the largest problet trains instead of a much greater number of small trains. In accordance with this policy the Virtuian operates the heaviest trains of any railroad in the world hauts them with the note. or any railroad in the world insulis them and the holest powerful steam lock motives I tainable and has had special 120-ton coal cars and double-dust air I rakes designed to sult its special service With this equipment seven million tons of coal can be bauded annually from the mines to the sea at Nor-

f lk in l until recently this capacity was ample. But now the production of the nines served by the railway, has reached this figure and unless the braffic capacity of the rails ay can be in reused in some manner a diffinite limit has been set; the oright of this im-The trouble lies at the gr less over the Allegheny

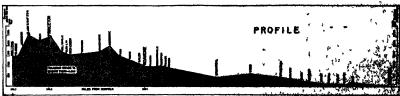
This electric locomotive will hard 6000 tons up the mountain grades per hour as compared with steam hardage of 5500 tons at 7 mil

Mountains Elevebers the cat moves freely snough to for crossing three mountains 6000-that trains must be cut down to 1000 tons and even when such of these mailer trains is hundled by three coups and articulated as the contract of the cont

with the use of stream homometries of any merors type helectification however, herorides a way out. If using a total of sold helmogeners of solicité homo-mun possible limit), truths of 8000 tons can be take up the grades at 14 miles per hour This peterical, double the present capacity of these tracks and et provides a considerable margin for fram provides a considerable margin for the provides and one of the solicite the provides a considerable margin for fram provides a routies must be made to the solicite the solicite that the solicite the solicite that the sol

nomann section of the road, where the difficulty is contered.

The system adopted according to Mr R L McLellan railway cagineer of the company that is supplying the electri cal equipment is the alternating or single-phase system with an overhead ley similar to that used with such as on the Norfolk & Western, New York on the Norfolk à Western, New York
Haven & Hartford the Pennsphysnia,
road at Philindephia, the Greand Tr
the Boston & Makes Railroad and
Eric Railroad the Spekme and In
Italiway and the Chicago Lake Shore
South Bend Railroad
Shel Bostonories—in



Profile over the Allegheny Mountains of the Virginian Refired, which is short to be charginally and

Light Weight Coment Slake That Take the

Pincic of Lyntheen in Building Operations, gainfully sinks recently developed by a New Jersey Constitution for second of the Jersey Constitutions are proving of finewest to architecture and engineen for behavior of these lightness extracts and adaptation of the second of the second

A state of the sta

cars to be trainsported and placed in a states that where the man was a state at the arch and a placed in equility to that the writtee metarical motive and runs into tanks below the consultation of the cons

them. However the dabla-bank has not despite con-trol than the sugar back, for it will likely out more. But there is a very good reason for dablis sugar said, cuty commercial levulous, or fruit sugar, which may be used in a no-sugar diet by bean it appear from dis-trict on the subject that this disease is increasing in this country and selenthes trying to find a sugar that people suffering from it may set At the pression and the subject of the sub-desting the superior of the subject that the people of the people of the subject that the subject that the people of the subject that the subject that the people of the subject that the people of the subject that the subject that the people of the subject that the subject that the people of the subject that the subject tha from using ordinary sugar Statistics state that there

Statistics state that there are 100000 people suffer-ing from this allment in this country so the discovery of a formula for making this sugar from dahlias is of great importance to the na onal health

The new sugar is one and one-half times as aw The new sugar is one and one-init times as sweer as cane or beet sugar and will hardly be a risal to the other sugars as it will be mere slong the medicinal line. In this connection it may be mentioned that sugar was regarded as a medicine or a luxury in



Laying the cement slabs on steel girders to form a roof which is inexpense

The Sensitivity of the Ear

The Sensitivity of the Ear Learning of the Carlotte of the Car

organ or regas notations of tables of the termination has been made of the relative multivity of normal ears of both men and women over the plick range from base O the faithest and the faithest and the radio of the faithest and the said the painfully loud. It is found that the sound energy necessary to produce a new touthest is mailteen and the said of sensations due to two lights of the same color or two frozes of the same pitch is proportional to the ratio of intensities of the lights or sounds causing the sensa-tions. This simple law holds only at mod-erate intensities. Phonometric compari-sons by a small number of observers were

some by a many many of the reversion of



After the coment siabs have been laid to form a roof, they are coated with a

Dahlis Sugar THE cultivation of dahliss has de besutiful varieties, and the Dishifts Sugar

This cultivation of childs and selveloped so many
I benefiti varieties, and the flower has been so much
improved that the first think the selveloped so commend as the first think the selveloped so commend a call for the sugar to be obtained from
the bulbs. They will also be surprised to learn the
more dable below on he raised to the acre in Cult
forth them sugar been. Nor does it cost more to rules

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Europe up until the time that the and coffee began to be universally used and not a necessity as it is now

regarded
The formula for making the dahlia sugar was worked The formula for making the dahlia sugar was worked out in the laboratories of the linkvesty of Southern California, and the head of this dipartment Dr Laird II is said that diabetic gaticuts have a great craving for sweets so it is a matter for ryboling that they will not have to be wholly deprived of them as been deprived to the contract of the contract propher of the American people of the California propher of the California people of the

consume more sugar than any nation in the world the increase over the previous

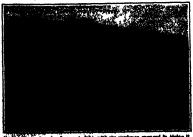
chaps when the dahlin remaps when the dailed fields get to growing, they will be allowed to flower though this is bardly likely as it will probably appear that it would detract from the amount of sugar stored up in the dablia roots

consumption per capita in the last year being nearly a hundred pounds. This is an in rease over the previous year Saccharine was the only sweet allowed those suffering from diabetes, and there has been some controversy in the medical field as to whether this was not harmful to the digestion. It has no food properties white sugar has as it furnishes been and energy for the owner.

Purther Testa of Stellar Radiometers and Measurements of Planetary Radiation THER Invess of Standards has been conducting for a number of year bindigate than been conducting for a number of year bindigate than the stellar control of the stellar control

oners a new field of Investigation on the variability of stars, etc.

In Scientific Paper No. 460 obtained from the Euperfortendent of Document's Government Printing Office, Washington D O at 10 cents a copy, improved the Control of the Control o



Perfection that make of content child, with the workman sugarded in piving it

When Light Speaks Recording and Reproducing Sounds by Means of Light Intensities DeForest, Ph D.

Y ATTLATION was focused on the field of talking moving pit trues whelly by photographic recurring in 1918. Ferhaps the one candidation which more than any their primpted me to ester a new and useful application of the aution amplifier—one which I could expect to develop anarehy by my own efforts an distinguished.

amplifier—any which I could expect to develop largely by my own efforts an distinguished trom its application to long distance telephony corps of experience lacked by a against busi-ness organization, were indepensable. As the most was my develor long anomalous of the link-rest short comings of the dis-machine notably the short length of nee-ord the necessity for frequent classiqua-tion of the contract of the contract of the experience of the contract of the con-cept of the contract of the con-tract of the contract of the con-tract of the contract of the con-peted to the con-tract of the co

control of the contro

passes through an extremely parrow allt and falls directly narrow ant and raiss directly upon one margin is accessed from the picture itself so that only the light from the Photion falls upon it. The film is driven continuously with an even speed in front of this narrow slit but with of this narrow siit but with the usual intermittent step-the protection in front of the picture aperture. Now the light in the Pho-

Now the light in the Pho-tion tube is generated by the electric current which is pas-ing through the gas enclosed therein The intreasity of the light depends on the inten-sity of the electric current Therefore if a powerful ris-phonic current is passed through the Photion the light emitted varies exactly in accordance with the in accordance with the strength in the telephonic current at thy instant. This light therefore, fluctuates in brightness hundreds of thou-



Dr. Lee DeFerent, the well-known inventor of the vacuum tube, with his intest inventors, the phonodim "talking picture" camera

phonic current pulses, and varies in strength with the

possible current phases, and where in atrength with the This telephonic current originates in the first place from the special microphonic transmitter which is quite some confinent telephonic microphonic transmitter which is quite the confinent telephonic microphonic transmitter which is quite the sound wave at distances of five to fifteen feet from the sound wave at distances of five to fifteen feet from the sound wave at distances of five to fifteen feet from the sound wave and the section of the sound wave fine to extract the sound wave fine to extract these to bring them up to sufficient strength to indisense the Photole lamp in the cumers. Without the sudden the Photole lamp is the cumers. Without the sudden the Photole lamp is the cumer would be statively in more considerable the sum of strengths of the properties of the sum of t

projector which is see that the interferee with its acclinary interferee with its acclinary interferee with its acclinary in the continue of t

amount of light fulling upon the cell Therefore, as the fills travels across the silt and the light fulling upon the cell anado to five-ture brughtwell upon the cell anado to five-ture brughtwell upon the cell anado to five-ture brughtwell upon the cell and therefore the silt and the small battery for supplying current, which cerrent is therefore centrolled by the light fulling upon the cell and therefore made as actly to reproduce the original balgonist in the cell and therefore the second to the produce the original balgonism. actly to reproduce the original tasphanic current from the transmitter when the aud picture was first recorded This country with the same that when the auditorial country is a series of superlay designed unloss suppliers, mart it is in tremely weak, and must be amplified, again through a series of superlay designed unloss suppliers, and it is in the country was a series of superlay designed unloss suppliers, and it is in the country of t

Spherical Aberration in Thin Lea

Spherical Aberration in This Lesses
TYER images fromed by inseas an imperior and it
is the task for the issue designer to compute issue
systems in which the faults in the image shall interfere
as little as possible with the uses for which the lens
is designed. The requirements for a telescope objective
while those for a camera feas are still different and
vary according to the particular type of work which is
is desired to carry out with the lens Lens designing
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Caterpillar infested with eggs Digger wasp at its med Thru Some of the insects that live by proving upon other insects, and the fashion in which they get their feed

Insect-Eating Insects Some Glimpses of the Eternal Struggle for Survival

By Dr. E. Bade

IFE, which is a continual battle for existence, is fought without separal to rules, one, is fought without separal to rules, and the separal to rules of the separal to rules. The separal to rules are reported to the separal to result in the separal to rule in the separa

in finding new means and ways to arrive at its desired goal. In this respect she is the most prolific inventor, she tries wars which appear harmless enough, but the

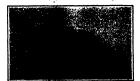
goal in this respect sits in the most position inventors, and in always the same, representation of the species.

The obese cuterpillar which modately sats one leaf after the other, can hardly be distriguished from the surrounding green of the foliage Suddenly it is fright-send from the meal by the appearance of a thread-small translating and the surrounding green of the foliage Suddenly it is fright-send from the meal by the specimen of a thread-small it finally alights near by The caterpillar senses danger, and lifts the unterior part of its body to a position of derease Nervously the wasp runs about the safe, the feeders where, to be suffered address in particular the same state of the same shows the same should be suffered to the same show the same shows the same show the same show the same shows the same show the same show the same shows the same show the same shows the same show the same show the same shows the same show the same show the same show the same shows the same show the same shows the same show the same sh

The paralysed prey is then cerried by the wasp to some previously due rawe or early, and an egg is then deposited on it. When the larva hatches from the egg, it esters its incultarity heat it once. Here the fatty parts of the enterpillae are esters, and when the larva are exten, and the exterpillae dies. Other solitary wasps build nosts of cay for their proug. These are usually from under eaves of houses. Other more than one cell it joined together, and each one is filled with a paralyzad polych, ff, etc., which are cuten alive by the larva. Through the paralyzad polych wasp provible in larvae with a ceatant supply of fresh

most sufficient to hast until they are ready to pupuls. The children of the control of the contr

Species of all insect orders fall victims to the rapacity of the ichneumon from. The Braconids infest plant lies.



The ground beetly estually overheals its victim by the way of "shank's mare"

They deposit an egg in the plant louss, and after a short while its abdesons will have become glassify discussed, and it you forms nothing more than a cavity transport of the property of the property of the property of the provided pr

live aimost entirely upon plant tipe and scale inspects and therefore deserve the most extensive protection. But busides these pasts, others are also destroyed, the age of the potent-best busing separative protection. But busides these pasts, others are also destroyed, the age of the potential process of the production of the producti



Three ners of the most repotent of the hunds that belt to bein three three three of the most repotent of the hunds that belt to bein three three

Immunizing Cabbage by Natural Selection How Nature's Standard Biological Process Is Adopted and Speeded Up by Man

By Robert G. Skerrett

The RNU were considered the cabbage as the Space in the American distary! Have present the American distary! Have present the space of the American distary! Have present the space of the

and, it presides indefinitely, and we are told that ordinary crops reduced as well their available controlling the starty crops. The starty crops reduced as well the carried in carried in the planted for a number of years and grow abundantly, and ye when coheapse are tried again its banden transparency of the comparency of the starty crops and year when control ranges does its destructive work unchecked.

These included divers method to be pain investigation having for their goal the evolution of control measures. These included divers method to be pain investigation having for their goal the evolution of control measures. These included divers method to treating out of the control of th

rece found. Thus inking a one from laters, produce by salf-developed in laters, and the later of laters of laters and from their curve was grown, in turn, on the worst been paints which remained sound and eached sublimboury maturity were naved a mother-bands for sast, procedure was been produced for Passerium-ventured and the later of laters and lat

emphasized further the good work of Dr. Jones and his collaborators. That is to my, there was an average of only 6 per cent of reliabova among the resistant or Wisconsin Hollanders whereas about 80 per cent of the commercial strains suffered actionally.

A warm soil encourages the virulence of Fusicism. The summer of 1919 was a hot and dry one, and dur-ing that period the relative immunity of the Wisconstin Hollander cabbage was put to a very severe test. Then, even the most resistant of this strain showed some ineven the most resistant of this strain aboved some brief dictations of infection, in short, an average of 70 per cent of all of the Wisconstant Rollanders was affected; and 20 per cent of the crep lived through the assessment. The non-resistant "controls" or commercial Hollanders were, without exception, attacked by the yellows, and only one per cent were still allow at harvest time, Today, a strain of the Wisconstant Rollanders has been brought into being which has not only the power or creating Pusarium to a metric dictory but it possesses

characteristics.

characteriatics, and reacteriatics, and reaches maturity earlier than the original stock. This strain has descended from a single head selected six years ago. A similar procedure has been pursued in developing cubages of other types so that they would have the selection of the types of his junior associates have lately reported that "These resistant strains have proved resistant so far as tested in other

POR 1920, some 104,850 acres in the United States were planted in cabbage, and 940,525 tens of the vegetable were har-

525 tens of the regetable term have
stated. At coverage prices for the
poor, the reduce of this crop was
\$75,000,000. The importance of
the cobbings-prisons industry to
plants are abbet to reduce
the there are not in the price of the cobbings crop
that there are not in the price of the cobbings crop
that there are not in the complete of the continues the principal cash crop; and three are associated
constitutes the principal cash crop; and three are associated
natures that stand or fall continuent upon good cobbings
harvest. Such us altegether the case in catesiare respons of
Wisconium, and it is upon a situation that to use there, and the
methods applying to dealing with it, that Mr. Sherrett writes
here.—That Extrem.



The kind of cabbage crop that can be raised when the plants are able to resist an attack of "yellows"

States. Our experience gives us confidence that through further selection resistant strains suited to any localized conditions could be secured. It is our belief, therefore, that the subbegs industry can be persuasestly maintainable in any section of the country, inscrine as the maintainable in any section of the country, inscrine as the carcular the subscrine of disease-ventrata strains. However, there seems a natural tendency on the part of cableages of this sext to revert to the original type unless seed is confinantly selection of disease-ventrata strains. However, there seems a natural tendency can the part of cableages of this sext to revert to the original type unless seed is confinantly selection the part of cableages of this sext to revert to the original type unless seed in the sext to the function of the sext to the sext to the function of the sext to the sex

the agricultural experiment station of the University of Wisconsin has, therefore, a wide field of application. The specific varieties developed in Wisconsin would presumably not be best suited for growth elsewhere; but the Wisconsin method can be applied in other places for the development of varieties suited to local conditions.

The Loudest Voiced Bird

WHAT is said to be the loudest voiced bird in the world is the bell bird, which is found in both south America and Africa. The naturalist, Waterton, y w world is the hell bird, which is found in both bouth America and Africa. The naturalist, Waterton, says of this bird, which is also called the Campanero. 'Its sung is found and clear like the note of a bell and is audible at a distance of five historotera. No song or sound of any other feathered firest dweller rouses so much wonder as the 'tolling' of the Campanero. single stroke of the bell is heard and these not each other at intervals of about a minute"

Act other at intervats or shout a minute"
The bell bird is pure while in color and about the tase of an ordinary piacoa. Its head is adorned (or disfigured) by a singular horay extracence, which is lifted for a distance about lifted for a distance about seven centineaters, while the bird is singing. It is this novable horay structure which is connected with the roof of the mouth which pro-vides the resonance which enables the bird to produce its singular bell-like note Every one who bears its re markable tone for the first must proceed from some neighboring church tower or campanile. It is a curious fact that the bird utters its song only when other voice are silent.

Geography and Intelligence

IN a recent address before
the British Association
for the Advancement of
Science, Dr Marion New
Marion Members bigin discussed the subject of Human Geography First Principles and Some Appli-

t can be raised when the a stack of "yellows" ration. Geographers are agreed, Dr. Newbigin eald, that there is a definite human geography, but little attention has been given to the problem as to the precise way in which man's response to environmental conditions differs from that of spones to environmental conditions differe from that of animate. Maccommon over an into a number of species at time when there was no distinctively human response, when adaptation led to specific differentiation, just as it does among unimate. But since all living men now produce the species of the species of the species of the peace. It is pushing appears to be associated with the fact that proving intelligence meant that the barriers of distribution, which limit the movements of animals

creased to function.

Obviously, this in its turn might have nevent that human evolution had stopped, that man had ceased to be adapted to any particular labelstate because fitted for the same of the control of the case of the lower organization, began to set in a new way. With the growth of cellivation, communifies became fixed to particular areas, and if the isolation was sufficient to ensure the poccasion of the control the text between the control of the

arting the residue gravel, dumped from the sieve,

HE ROMANCE of the dismond-fascing

IIIR ROMANCE of the disumond—fascinated up to the control of the c jungle hase, has lighted up that country with the sparkle of its own gens, and has given the hope of wealth, to those, at least, who will intelligently work for it, and take the dare of mosquitoes, malaria

and take the dare of mosquitoes, mataria and a generally trying climate Even the primitive methods of the un-skilled natives are yielding large returns, but Mr La Varre feels that with the in-troduction of modern ideas and machinery a new RI Dorado will be revealed. The a new fel Dorsdo will be revealed. The promise and potency is in his bringing back to New York, some time ago, a cluster of diamonds of 150 carats, re-cently be returned with one of 500 carats, also the largest single stone, it is claimed, ever found on this continent, the "Kuru pung," of more than 30 carats Incident latip, it may be said he has gathered specimens of bride and animals for the attheonian Institution

and the second of the second o The new region of mineral wealth lies

or Negro lineage. They gather at Bartica, the outer-most point of civilization, and wait for a prospecting party that may require extra paddlers. Sometimes they party that may require extra paddlers. Somethness they "conness" with a supply boat point to the trieding posts in the minding districts. The trip takes several weeks, recard tage receives because in the shape of a week's supply of glick, rice, sait this, etc.

The flatter prospection meanly begins his work in any point of the state of the said of the

Diamonds from Guiana

How the Precious Sparklers are Recovered from the Gravel

By Frank Munro

might see in the bush. A negro (giant in size and cled only in a bits cloth) stood kneedeep in the creek, and with the properties of the clede of the creek and of the clede of the clede of the clede of the clede old man, who did the "clentific part of the job, that is, the jigging of the grave in the round sters. Dis-mod production deponds largely upon the jigger if he is carried and knows his work, there will be no loss.

he is careful and known his work, there will be no loss.

"The old man was autrife a nool about three foot wide and two feet deep. By a series of calculated works and two feet deep. By a series of calculated would serve to context the heav tent unterful in the obtom of the aleres, and as diamonds are the heaviest of the publies, they naturally are the first to respond to the inversencia. Where diamonds are found there are fixely to be also tim, carbon and publish, suited with

likely to be also tin, carbon and pulatic, mixed with oparts. These minerals are hevrised, next to dismonds, and are therefore also sent to the bottom, and the sent the sent to the control of the water and turned from left to right while in a level position. Then it was quickly lowered and raised, and shaker from side to side. Finally it was swing around while tilted. After a few moments the man accoped up the top gravel and three if a way, these is edded are gravel to that left in the sleve, and repeated the operation

"By this time there was left in the sieve only black carbon, brown pulsite, and a small center of tin, in which the diamonds, if any, were to be found. The sieve

The "long Tom" in action, washing gravel and serting out large stuff propers-

tory to jigging

was now turned upside down on a piece of level canvas and few pro-

taken from the soil"
Somewhat in contrast to Romewhat in contrast to this, although essentially primitive, has been the procedure at the mine known as Le Desire. It is located in the attential deposits in Course the Course since depositing a 50-foot pile of disumend-bearing gravel, and giant trees had grown up. These were cut down, and turnished the beaus for the sharts. Here tous," and several facers.

the gravel is washed in "long toms," and several juggers are employed.

The "toms" are troughs placed at the outlet of a dam in the creek In each are inserted three sleves of

gravel is dumped into the upper end of the trough and washed down by the pressure of the waster continue through from the dam above. The larges existing and gravel are kept back and therom area. After passing and the statement of the statement of the statement of fulls into a rectangular flat steve that is suspensed by four chains from a scanfolding in such a way that the pool below just covers the bettom of the slews. A man stands in this water and shakes the container. This gives the flashing touches to the vashing. Then the gravel is brought to workers who "light" it in large Diamonds are easily identified in the raw state by

where the constraint of the co

in the creek beds are the alluvial deposits of a primary formation, that is, they come directly to the stream gravels from the breaking-up and erosion of the rock in which they were formed. Alternate changes in tem-perature (heat by day, chill by night) will sometimes

set by day, cold by night out it contents as the day, cold by night out it contents that the means as safe in this, the mass having received as initial impulse or direction. All this means easier mining and a queles trucking of the sources, and the day of the day

ignorant or the true value of cases amounted in the superior such household aids as potato-scrapers! Now the bort, or chips, find their way largely to British manufacturing plants, where highly pollahed surfaces of

plants, where highly polished surfaces or sized are required antive prospector has both sight of a line fact that diamonds for sight of a line fact that diamonds is which they are found head to those sources. It is hard to push on when one finds that genus ile beneath one's feet, but if one is to reach the real tressure one needs to go abend. With little capital ristors, the natives are not sight to let the





Dayton's latest landing signal for the night-flying

A Beacon for Aviators

A MOTOR track wose eagine supplies electric cur-rent for lighting a powerful searchlight, in the form of a become for guiding aviators when flying at night, was recently demonstrated at McCook Flaid, Dayton, Ohio. The same engine that furnishes motive power for the operation of the motorized vehicle also is the source of current for illuminating the brilliant

searchilish.

The light radiated by this new type of hencen is of high intensity—400,000,000 candisposer—and the result of the light intensity—400,000,000 candisposer—and the result inches in diameter By the little intensity of the result in the result i

The Gipsy Moth and Doad Trees

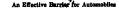
THE gipsy moth has now spread over a large part of New England and is in position to continue its states, and the rest of the land. During the past two years it has moved westward, fifty miles. At the rate of 25 miles per year, the death of our trees. rate of 20 mines per year, the death of our trees, especially the oaks, can be predicted by arithmetic unless help ar-rives in time. To combat this threat the Federal Gov this threat the Federal Government has been spending about \$150,000 per year, but this has only retarded the spread of the moth. Those who have seen the chestnut trees in the East standing out in the forests like gaun stark skeletons as the result of another destructive

or another destructive agency whole states, will sagency which rapidly spread over whole states, will best be able to envision the oaks, a more numerous species, silhouetted against a mass of green, dead. On Cupe Cod, where the moth has been active, 90 per cont

Cape Cod, where the most has been active, 80 per cent of the coles are edged it will be the turn of the New York Wate oaks to die next, unless wenething is done, for the moth has already exhibited itself along 76 miles of the easterp border of that sake Blogopius arrange with the sake of the s

of the circle, but the fire-fighter can work from only one place
Pursoing this analogy, it has been proposed to establish a barrier sone from Long Island Sound to Canada, having a width of 25 miles, beyond which the Olpy Moth shall not be allowed to establish itself. This really smounts to applying the some exterminable intelf. This really smounts on physical to the control of the control of the accessory to a noty to the parties are inference when

measures to a narrow scrip as would be interwise necessary to apply to the entire area infested. Owing to the prohibitive cost of establishing control of the moth in the forests, except in a limited belt as a of the moth in the forests, except in a limited belt as a protective or defensive strip, it is nearly impossible to grow many of the most valuable trees to timber size in hadly infested areas. Therefore these may produce little else than acrub and brush. A failure to recognise little ciec than scrub and brush. A failure to recognize the possibilities of a Agarier Nuce, and to provide means for combatting the ruitnous peel within its limits may of an activately indurious forces that at a time when every effort should be made to conserve and increass our forcest and forces products. Within such a limited area, it is insertly a matter of concerted activation, appraign, etc., to suppress the moth offerts, by bruing, appraign, etc., to suppress the moth



An Effective Barrier for Automobiles
CAN FRANCINCO, the dry of high hills and service
GAN FRANCINCO, the dry of high hills and service
grades, has solved the problem of getting the spillers
across one of the attifest of these eminences, early
Peaks, hy boring a tunnel beneath the ridge. Zen
tunnel is fatteded only for the irrilleys but its entrance. is so situated with respect to the automobile road that tumerous automobilists

have, in perfectly good faith attempted its passage—aside from those who, in bad faith, have preferred going through to going over Unfortunately, to going over Unfortunately a to going over Unfortunately a car and an automobile in the tunnel, and the chanfleur who meets a trolley half-way through has to back out, to everybody a great inconven ience. The trolley company finally hit upon a novel expedient for keeping the intruding automobile out of the tunnel—the con treat truding automobile out of the tunnel—the concrete ditch shown in the picture at the lower left corner of the page The ditch is three feet wide, and, with the trolley rail of upstanding Termin its negotiation by a car or truck would be quite out of the question, and no chauffeur would attempt it.



The mirror that gives the motorman a last look at his trolley wheel before entering the tunnel

A Mirror in a Novel Place

A Mirror in a Novel Place
THE ingenuity of San Francisco's tunnel builders
I did not stop with the automobile bar described in
A did not stop with the automobile bar described in
be settremary difficult to replace the trolley wheel on
the wire, if it aboutd come off In the straight run
through the tunnel the possibility of its coming off is
through the tunnel the possibility of its coming off is
through the tunnel the possibility of its coming off is
through the tunnel the possibility is fairly large. So the little
mirror illustrated has been installed, and the motorial
is expected to assure binself that the trolley wheel is
property seated before he cuters the brow.

The Talking Traffic Lamp

The Talking Traffic Lamp
A UTMOBILIST'S whose of triving takes them into
A the surburban towns of New Jersey have been
reverted surface the post few mention to acce model
to the post of the surface of flashing lights can be seen for a mile or more when the configuration of the road permits, and beace the driver has ample warning of the danger spot. Sevend, when has ample warning of the danger spot. Sevend, when the comparison of the should obtained the second of the should obtained the should obtained the second of the should obtained the second of the should obtained the second of the should obtained the should obtained the should obtained the should obtained the should obtain the should be shou take the place of the arrow and the admonitory lettering Both by day and by night the motorist on all this as he approaches, without stopping



The estimate Sich that keeps automobiles out of San Francisco's



New traffic signal that is easy to find and easier

Carrier Current Telephony

Guiding Radio Telephony over Existing Telegraph, Telephone or Fewer Line

By B. R. Cummings

If IR a matter of common knowledge that a shaple electrical conductor can be made cut and a shaple conductor can be made cut and function in such circuit in such circuit and function in such circuit and function in such circuit and such conductor to curry both alternat mag and direct current, or two or more alternating carnets of different frequency characteristics, simultaneously.

These currents do not exist independently in the con-ductor, however, and at any instant the current flowing is the sum of all component currents. While the current in the conductor is the resultant of individual currents, it is possible to attach to such conductors suitable groups of apparatus, so that one

group will respond to the current of one characteristic, and the other to that of the other characteristic

the other characteristic This fact is somewhat analogous to transmission by radio at different wavelengths. The other which is the medium which conveys radio signals, in carrying a very great number of Independent communications simultaneously, although we are able to adjust our radio receivers as a contract and output our radio receivers as that we can select signals at one frequency, and, with sufficient frequency sep-aration, hear nothing that is being transmitted at other fremencies.

are transmitted by conduction rather than by radiation, a conductor may be made the medium whereby a great number of signals, having individual characteristics, are carried simultaneously, and each can be received by apparatus which is ad-justed to select any of the incoming

signals. This phenomenon has found growing application in communication systems. For example, if a group of wire lines between two points are being used for telephone communication to their especity, additional communication can be provided between these points either by erecting new lines, or by making the existing con ductors carry additional load of charac-teristics differing sufficiently from those of the existing load to permit its inde-pendent reception. The choice between the two methods becomes a question of

economic selection Similarly, if communication is desired between two points already connected by lines used for another purpose, such as for example, a transmission il no for the transmission of power, it is possible to utilise these lines for telephene communication, rether than erect an independent line for

this purpose.

The method used to superimpose telephone communication on a line already in must be the phone communication on speech by the musul methods, or for the transmission of speech by the musul methods, or for the transmission of power, lies in generating an allemanting former, lies in generating an allemanting lating it is much the assume manner as the output of a radio transmitter in modulated, and coupling the generator to the line. At the receiving end, apparatus is used which sunswint resombles a radio receiver. This is also coupled to the line, and tund to the frequency of the communication which results, is known. The sprices of communication which results, is known that the the three communications is curried by the high the the that the communication is curried by the high section.

as "Carrier Current Pulspiony," a name derived from the fact that the communication is carried by the high recouncy source rather than directly, as in the case of the seast ledeplone line. Heavily so the seast ledeplone line of the seast ledeplone in t

it can be applied to existing lines. For example, it is customary for power companies who maintain long transmission lines, to provide for telephone communica-tion between their various stations and sub-stations, by running wires either above to below the power lines. Such procedure, while undoubtedly serving its purpose to a certial existent, is subject to failure from a number

of sources. For example, the entire line from one station to the other must be maintained intact for communication to the maintained. The fact that the line is expeed to damage for a great many miles nation it probable that it will be brought down by severe wind or hall storms, putting the telephone service out of commission. The fact that it runs this distance also exposes it to the

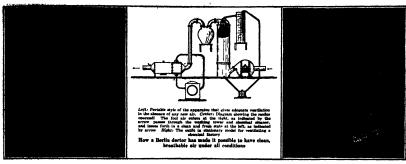
hanard of becoming crossed with white the ti

monus rail For current telephony over france the exposure to such failure is agreeded. The currier current telephone equipment, the tenamination line by means of a capacitorm or another. The maximum, exposure such installations, is that of one or means or extend for a learner of 2000 that handled. such installations, is that of one or mains oblights strong for a longit of 1000 dws pleasable; the, it is strong for a longit of 1000 dws pleasable; the, it is ston time. This is necessary at both, the trisies and receiving station. The pleasable opposites, the pared to the total length of the libes. The relief powers of the carrier system also lysuition in greater fraction from districtions of both, and on executatived fit polysicals. However, the con-cession of the complete the contribution of the recommendation. Bears over the Manney of the contribution of the complete to the district.

while meriter despitati indicated a special country country operation, a closest market in the country operation of the country of

otherwise be required, it is the more secured communication represent currier current communication interests communication interests communication interests or communication interests moved in the communication interests or communication interests or communication in the communication in the communication of the communica

101



Making Old Air Better Than New By Dr. A. Gradenwitz

By Dr. A Gradeavits
WHATSWEER the organism produces by its normal
Water space, mixed with mortial germs and the dust
raised by a multitude of operations and nade all the
more offinancies by an often uncomfortable rise in the
presture; whetever industrial processes turn out in
more offinancies by an often uncomfortable rise in the
presture; whetever industrial processes turn out in
presture; whetever industrial processes turn out in
a prefording movement of air. Now, what can the "fresh'
air desived from inhabitated areas, supeclaity in
diametry populated citias, be expected to yield for vortilation purposes, filled as it is with similar impurities
in addition to the dust and small left by passessy
and well-tellar trailed field, for want of butter, we shad
opening our windows for the sake of ventilation and in
connection with those ventilation plants admirable from
other polats or view.

consection with those westlation plants admirable from other points or view.

A medical practitioner living in Berlin, Dr Albert Wolf, has derived a remarkable new scheme enabling the sir is a closed room, within a minimum of time, to be portectly respectively. He was a substantial even the most to be portectly respectively. He was a substantial even the most respectively. The process has not proportion to make a sowering its emporature in manner and rables; it is winter—all without any supply of outside sir. The process has now been developed to a commercial stage and, the control of the control of

in operation on a large scale. The process consists of three consecu-tive stages, the first of which is optional. It is a subject to the remaining from computery Whenever, to fact, deat of an especially coarse descripting is guizated in the rooms to be well-laid, an incombartible mechanical remaining the subject of the process paper, the war and issue. Tails, of opares, is quite biogenetical of the process peoper, the undergrings perhelpile of which can be stated as follows:

The oxidizing solution is obtained by the action of some on metallic chlorides. The resuret, after except matter of the control of the contro

The whole of the oxidizable uniter is submitted in the washing tower to the continuous action of nascent oxygen. The most offensive odors are totally absorbed by the apparatus. Morbid germs from the but al cavity, according to tests made at the principal Berlin hospiaccording to test make it is principle bertal needs facilities, are annihilated completely. The most remarkable feature in this connection is that on account of the instantaneous destruction the apparatus always is sterile and never, like other filters, becomes a focus of

The carbonic acid of the entering air is, by a special chemical process connected with the filling material, reduced by degrees. An apparatus dealing with about 800 cubic meters per hour takes up a space of about two cubic meters and requires an expenditure of about three kilowatts per hour for its operation, inclusive of the cooling effect.

The very finest dust particles suspended in the air

and as which all filters so far in use had been without any effect can thus he disposed of The process will prove especially invaluable in the case of industrial prove especially invaluable in the case of industrial production of offsets we see that the case of industrial production of offsets we see that the case of the process he considered the case of the process he considered with the case of the process for the asceptic treatment of wunds without any dreading in Berlin military hospitals. If example case of the process for the case of the process of the case of t conditions

An additional advantage is that, wherever required,

An accultural accumpage is that, where required, any valuable material can readily be recovered from the air thus treated. This possibility has stready been made use of in the chemical industry. This German device presents an interesting development in ventilation problems. Heretofore, the usual idea has been to expel foul air and take in frostor so-called fresh—air from outdoors. There have also been devices for producing owner for the purpose of destroying bacteris in the foul air, but, as pointed out, this pungent gos irritates the lungs. In crowded districts the problem of good air is a pressing one.

attr divoloped "sp hiter" for applying the principles of spectroscopy

Chemical Analysis With the Spectroscope

SEPARATION by ordinary means of sufficient quantity of an impurity to determine its nature is often a lengthy determine its nature is often a lengthy process. With a spectrometer, on the other hand, the prosence of spectral lines other hand, the prosence of spectral lines of the control of the c

invention to the amount of the imparity apparetus for such determinations as these is recently on the manufacture. It is shall fire in apparentus east size takes no more room on the table. The checked part is the supplex of the table. The checked part is the supplex of the checked part is the supplex of the checked part is the supplex of the checked part is the checked part is the checked with a lever, and is rotated by results of a micronizer server pressing a form of the checked part is t scale of wave-lengths. The index m

What Makes Glue Stick?

Some Studies of the Roles Played by the Wood and by the Adhesive

By Eloise Gerry and T. R. Truax Of the staff of the Forest Products Laboratory, Madison, Wis.



OOD, because of its cellular structure, can be glued more easily than many other more constraints and the glues or mexical. The squares, the cell cavities or the present the becomes fronty anchored when a good glue has be-

when a good give has be-shear or tear spart the solid wood without breaking the glue joint

glue joint
The accompanying pletures of plywood as seen
under the microscope, illustrate the appearance of
some veneres glued together
with the grain of alternate
plies running at right an
gles to each other. The
unanner in which the glue
enters woods with different
those of streams.

types of structure is shown.
The material here presented was obtained in the course of investigations now being curried on at the United States Forest Prod. ucts Laboratory to deter mine the effect of various mine the effect of various insolated factors, such as wood structure, pressure, length of assembling period, modsture content, and temperature of the wood, upon the results secured in gluing different species of wood with different kinds of

Given which are commonly used as adhesives for wood may be claused as (1) animal and fish gine, (2) vegetable giue, (3) casein giue, and (4) blood albumen giue. For a comparison of differ ent gives as to manufacture. properties, and uses see Re-port No 66 of the National port No 66 of the National Advisory Committee for Aeronautics, entitled "Gluce Used in Airplane Parts," by S. W. Allen and T. R. Truax In all the woods examined it was found that the various giues did not pene-trate the cell walls but en tered only the exposed openings of the cell cavi-ties. As is evident in one or and the second secon

and amo tendes to persuit the gine to penetrate to the outer surface of the panel and produce undestrable staining. At B, on the pic-ture, lightform the penetration as it appears on the end grain. From this it is apparent that the diagonal pene-tration of the gine may extend some depth below the spread surface. Were the manner of its entrance not

resilind, the appearance of the penetrated porce at B might mislend size into thinking that the gine had penetrated directly through the cell walls from the hand, after poster (at, the first view) or make for at wome point are in centuct with the spread surface and the penetrated of the penetrated o ALC: NO.

isolated. Penetration of the fibers, P, therefore greatly str Typical glued joints of different characteristics

face, as A to O in the left view of the bottom group. Provided a continuous film of gine is present, and sufficient penetration is obtained, the hickness of the glue line in the lotat may vary considerably without appreciably inflecting the strength of the union. This

iongrudinal surraces of resa-tively conse-taxtured woods can be glued very readily In joining end-grain sur-faces, on the other hand, large, open pores tend to absorb too much glue and cause a starved joint, unless cause a starred joint, unless apecial precautions are taken. The evenness of the distribution and the abun-dance of the pores, especially on longitudinal surfaces, are very significant factors in successful.

on impersantial surfaces, are on impersantial surfaces, are successful glienthorized.

From a standpoint of the number and distribution of the number and distribution of the same treatment basewood could be gisted more smilly than oak, where surfaces are suffered to the pores were the only means for holding the pines, may occur if the pores, may occur in the pores when the pores, may occur in the pores, may occur in the pores when the pores were the cally means and the pores, may occur in the pores when the pores were the pores and the pores an s', m our second view, is a significant factor in such woods, however, and is to some extent necessary if a strong joint is to be ob-tained.

Selders for Aluminum

CIECULAB No. 78 of the Bureau of Standards en
(rited "Solders for Aluminum" has recently been
revised. It will seen be available from the Superin-

retrant. It will som be available from the Superinsedeet of Documents, Government Printing, Office, Washington, D. C., at 5 cents a copy Most of the suntial commonly used in solders, except magnetium, are electro-positive to aluminum, no that make the contract of the suntial commonly of the suntial contract of molecular the suntial commonly of the give the best results.

give the feet results.

The tensile strength of a good aluminum solder is about 7000 pounds per square inch, because those with higher tonsile strength usually have such a high temperature of complete liquidation that they are usualized for soldering. Usually the strength of an aluminum soldering. Usually the strength or an accommun-red joint depends upon the type and workmanship.

a 50-horsepower electric

motor
The 20-foot tank has 1½-inch lines each 7 feet 6 inches long, radiating from the ester of the tank to separate individual water distributors spaced equidistant circumferated. entially During one of the demonstrations 12 inches of oil or 850 gallons was used in the 12-foot tank and allowed to burn until the fire was going strong, the fire being tinguished in five seconds with 25 gallons of water The fire was actually out in less than conds, in fact, almo

hve seconds, in ract, almost immediately on the applica-tion of the water curiain which is produced by the water distributors, the latter spreading an unbroken currain of water over and above the surface of the burning oil,

A four-inch water meter is installed in the suction line leading from a 3000-gallon water storage tank to

Experimental fuel oil tank equipped with a new system of water distributors for distinguishing oil fires

tons in weight and 160 feet in over all length. The other weighs 160 tons and measures 177 feet over all. The work was done in December, and because of the leavy tide which runs at times at 7 keets in the Mersey, and also on account of the unsettled weather in December, it was necessary to complete the job of

, it was necessary to complete the job of removal in one day. After the floating erane had been bridge was lifted by four elling stare, the bridge was lifted by four ellings stare, the bridge was lifted by four ellings stare, the start of the star of the star of the star of the griders at about the third points, the slings consisting of specially facilities with rose, ask inches in circumferace. Bach double aling passed around a hardwood block on the under side of the bottom

chord.

When lifted, the overhanging portions beyond the slings were, of course, subjected to complete reversals of atress, nembers becoming compression numbers. The diagonal tension bars in the overhanding portions were relieved of compressive sfress by meshs of slings passing from the upper panel point to the opposite oliver panel points in the oppo-site direction to the tension bars in those

In the work of removal, the 200-ton creme was towed up to position advantaged the landing risar, the jib was slewed the lifting hooks made fast to the slings above mentiteed in five misutes the bridge had cleared its bearings on the pier. The jib with its lead was then slewed round and the bridge deposited on the deck of the crans positions. The crans was towed some power of the crans the sline of the crans the conditions to the conditions the crans the conditions that the conditions the conditions the conditio In the work of removal, the 200-ten

The crase was tower some two mines and moored to the river wall just south of the Seaconbe Ferry, where the bridge was lowered on to timber grillages pre-pared to receive it. The work of removing the two bridges, transferring them two miles to their tem-perature resting place, bringing them back, and putting them in position again, was done without any mileshap



This bridge moves out of the way for passing river traffic by sliding diagonally on the rails shown

the bridge moves to a position parallel to, but a short distance inshore from its usual location by this diagonal movement. Putting Out Oil Tank Fires With

THE application of water in the ex-THE application of water in the ex-tinguishing of oil tank fires was suc-cessfully demonstrated in San Francisco recently before representatives of various oil companies. The demonstrations were

A Draw Bridge Which Slides
Diagonally
THERR is amenting decidedly different about the draw bridge shown in the accompanying illustration, even though it has been in use for several decide. Because of the limited speak about the latest about the bridge, which spans the Broux River in New Tork Cilly, has had to be River in New Tork Cilly has had to be a latest a bridge, which spans the Broux Britan and the Broux and the

which ride on rails laid diagonally to the line of the bridge. When the bridge is to be opened for river traffic, the bridge attendant pulls the bridge along the diag-

given near one of the municipal fire e

given near one of the municipal fire esgine houses, where a tank 20 feet in diameter and 4
feet high, and a tank 12 feet in diameter and 4 feet
high, were installed, both tanks being connected with
a contribugal pump having a capacity of 300 galloss of
twister per minuse at a discharge head of 100 periods of the line
per square inch. The pump was directly connected to

line near the tanks.

This installation gives sufficient flexibility to regulate

to a nicety the water curtain desired, in addition to being shie to take readings on wa-ter consumed, pressures de-veloped friction head loss in

line etc The water distributor is the invention of a San Francisco fireman by the name of

A Crane Which Removed a 150-Ton Bridge Intact

Our illustration shows how a large floating crane, because of its great lifting power, may effect under certain conditions a considerable economy in time and siderable economy in time and labor In this case a new 200-ton floating crane was brought into service in con-nection with the reconstruction of the landing stage at New Brighton near Liverpool. As part of the work, it was sary to remove the two necessary to remove the two steel passenger foot-bridges, leading from the end of the ferry pier to the floating land-ing stage. One of these is 122

Auxiliary Condensers and Loading Coll A FOURTH circular in the series of descriptions of A FOURTH circular in the series of descriptions of Bureau of Standards has just been issued. This is Circular No 187 entitled, "Auxiliary Condenses and Circular No 187 entitled, "Auxiliary Condensers and Loading Coil Used with Simple Homemade Radio Re-ceiving Outflix," and can be obtained from the Govern-

caviting Onitins, and was be obtained from the Government Printing Offices at le ceits a copy Circulars 129 and 121 described a single-circuit receiving set and a two-circuit set, respectively. The operation of either set can be improved by the use of a very simple and cheen condense councied across the teleparter of the control of th

cular) is added to the receiving set.

The condenses used in series with the antenna makes
it convanient to tune to wave lengths less than 300
convenient to tune to wave lengths less than 300
colvers increases the intensity of signals which are
received from some radio stations. The leading odl
saniles the equipment to respond to wave lengths adove
600 meters, up to about 3000 meters. Thus signals from
high power stations can thus be received.



land Bolding elemn lifting a 148-ton bridge, tofact, to the crease position

Concrete in the Making

Ingenious Production Methods Evolved in the Portland Cement Industry

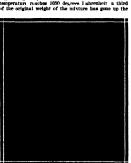
By George S. Eaton

OUNTAINS of rock, in effect must be powdered yearly in the portland consent in the post of the control of the policy of the post through the policy of the p

without two great inventions the portland connect industry could not have attained its present dwelop-ment 'One of the was the reducer' to the other was a second or the property of the property of the property of the property with a low in labou e.s. and what is of greater importance makes production on a mammosh scale featable. In stead of a south hundred bertich a day from the instead of a south hundred bertich a day from the instead of a south hundred bertich a day from the instead of a south hundred bertich a day from the instead of a south hundred bertich a day from the latest of the provident of the state of the provident with the form of the first production of the first grind ing mill! Anxien who is familiar with an old time plant with its forty or fifty, mill pickers bury with their hummers shatigating the intristence case used in would not be practicable without the highly developed iron or steel grinding suparatus of today. And the development in either of fibre two mechanical fields alone would have been laundreden—their correlation. was resential

The huge rotary kilns found today in the coment plants of the country make most unusual furnaces one of the largest could be set on and it would be as tall us a 20-story building. It is more than big enough for us a 21-story building. It is more than big enough for a touring our te pass through it is he selver than four standard pullman cars. Secret of these steel monsters slowly revolving side by side in a great kiln room with %0-foot (ongues of fiame rouring within them and whitebot bells of clinker dropping from their mouths create an impression of power and relentiess purpose that is

The raw mix consisting of property proportioned and nely powdered ingredients enters the upper end of many powdered ingredients enters the upper end of the kiln. As this slowly turns a revolution every minute and a half or two minutes, the powder is car-ried up the sides before it tumbles down and fi reard due to the kiln a slight inclination to the horizontal. due to the kins a signr inclimation to the formontal, An moisture in the raw mix is soon driven off and as the material grows botter and hotter the lime carbonate begins to give up its carbin dioxide. By the time the temperature ranches 1650 degrees I shrenheil a third



Shooting a notch through a clinker ring in a klin may nave a two-day shut-down



A centrifugal type of mill for pulverising material in

stack as carbon dioxide alone If a pure ilimastone were being used without the clayer elements added, the loss from this source would be 45 per outly pot, with good class. Near this lower and or the kiln the fames attain a temperature of from 2000 to 2000 degrees Pataelli-—a heat great enough to melt the steal shell of the kiln if it were not from the protection of the first-left kilning At this (unperature, the materials are at the point of incipient Tustes and it toles finely produced state, pround into portland ceasent.

The free implyord in produce this attracts empera-

The fuel employed to produce this extreme tempera-ture is usually powdered coal itself the result of pul ture is usually powdered cost itself the result or put-vertising operations like those to which the raw mate-rials are subjected. Once so finely ground burns almost like a gas faine. Millions of tons of poliverised cost are consumed every year in the kills of the cement mills, Great quantities of field oil and natural gas are also

tireat quantities of feel oil and natural gas are also used.

Location of the busining as non-importent feature. Control of the busining as non-importent feature. Control of the busining are the feature in the control of the busining and the feature in the control of the special control of the control of the special control of the con

it to collapse. Shortun shading a charge of one yange of leed ap-employed because of the built of the ring. Jacob Sev-la constial, so that sight or ten gons are provided in-order that they will not proceed too loot. One map likes

white others lead. The blast of coal dept is sheet of to affect a clear sight, but the kin is ablowed to repoire from 100 to 1000 about must often be sum that of the proving trapet, which means that the hardsonstit shoulder receives a territio proading from the recoil of the beavity stonded grass. Denotes at it is, this physical method of the beavity stonded grass. Denotes at it is, this physical method of the proad of the physical method at the particles of raw materials brought into close context at the very high biful temperature, which however, is shall be very high biful temperature, which however, is shall be very high biful temperature, which however, is shall be very high biful temperature, which however, is shall be very high biful temperature, which however, is shall piaces, roughly spherical, ranging in disnesser from one-parties of an inch or less that the very high biful temperature which is shall be the properature of the shall be the same than the shall be the same than the shall be the same that the same than the shall be the same than the same tha

While clinker needs only to be ground to become crosses, which is a substance that will become solidity into a permahently rigid mass upon a dedition of water, clinker itself is inert and can be exposed to the elements for menta without deservoration. Prospectly it is spinkled with water while cooling. Fine pulse iring is necessary before any eccenting action can take

Iring is necessary before any cementing action can table Present grinding machinery commonly utilizes the principle of pounding the material between score form of hammer and nother metal mans. But the hammer may be a nicel built man of steel the man of the control of the cont



got the others at the betters of the firm. The crushed substitute peoples is trovinch, ring, is field in at one and of the rightness. When like scough, it passes out through a substitute except that is fastened to the steel liming sides, and regards with the shill. The particles leaving at half mill openmenty are about the size of medium-

AUGUSTA TOTAL

pulvariant.

Shoel cylinders 20 feet or more in length are very clear simplying in reducing the product coming from the half all the length are very fine provide that is fed into the half all the length of length of

Absort any operation in the long manufacturing process contributes something unusual For example, consider the sacks of cement seen on practically any construction job. Very pro-

construction job. Very pro-sale in appearance, certainly—yet those sucks were so-curely tied with steel wire before they were filled with recessent. This operation of filling a fastened container is performed many millions of times a month, for in 1822 among a performed context and the properties of the con-traction of

such had to contain 94 peeding, it was measurery to stop and weigh each package before it was tied, adding materials as needed to being it to the standard weight.

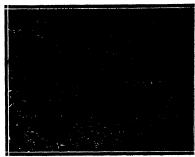
Today the filling is done by machines, and these machines have brought with

them this type of most that is that before it is hips. The sack is provided with a self-closing valve in the bot-tom through which casess flows in, sided by an elab-orate mechanism.

When the monistic 56

orate mechanism.
When the requisite 96
pounds of conent have been
put into the bag, the flow
is cut off by means of a
scale, automatic in operation. The full neck them
drops to a moving belt that
carries it out to the freight
car By this method a crew
of four men can fill and load
8000 secks a day against an 8000 sacks a day against an output of 1000 under the old hand-labor methods. The valve itself is made

when the cloth sack is sawed up, by folding over one bot-tom corner before a seam is run along the bottom and up one side of a doubled strip of cloth. When the sack is turned right side out this flap valve forms an in let through which coment can flow The sack is hung on the filling machine up-side down with an inch tube



Cement clinker is an inert substance, but when ground into cement it so hardens on addition of water. The grinding brings it down from the size above to an almost impelpable powder that will pass through silk cloth

Both the preliminary and the final grindings of the clinker and the coment itself are carried out in ball mills of one nort or another, of which this drawing above a typical example, broken away to reveal the mechanian

inserted through the valve.
Once filled and righted, the sack is proof against leakage, since the weight of the cement holds the flap valve

In the raw materials from which portland cement is made the major constituents made the major constituents
—line, silica and alumina—
must be present in the right
proportions. Also they must
be unaccompanied by injuri
ous amounts of other lagredients. Proximity to centers of population is desirable, as freight charges mount up rapidly upon such a heavy. low-priced commodity as cement: This means that usable deposits suitably located for economical manufacture are comparatively rare. Yet the raw materials rare. Yet the raw materials themselves are a small part of the cost of cement married the cost of cement married the cost of cement married to the cost of machinery, the fuel for burning the clinker and the power needed to operate the milks that are the important factors. Last year portland cement was made at 117 plants in 27 States located in all sections of the

105

The combinations of materials commonly hurned together in manufacturing cement are limestone with cement are limestone with clay or shale, limestone with blast furnace alag, cement rock with limestone, and marl with clay. In each case, the principal constitu-ent is named first.

Cement rock is a stone found principally in Prancylvania, that com necessary elements in ap-proximately the correct proportions. Mari, in the sense neant here, is a granular, loose deposit of limestone found in the basin of an existing or extinct lake The blast furnace sing referred to is especially prepared for coment manufacture by arried out in ball
a sway to reveal
Two general processes of
manufacture have been developed, the dry and the
These vary in methods but not in principle.

wet. Insees viry in menoious out not in principie.

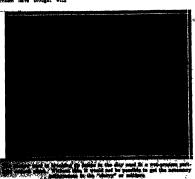
In the dry provess, rock is crushed to a two-inch size
by passing the pieces from the quarry through some
sort of a primary crusher, followed by a battery of
smaller ones. Materials are next dried, and then go
to the grinding mills for pulverising before they are

berned.

Siliency is the term applied to the raw mix in the wet precess, used where marl is an haproleus and in some and the source of the sou ing in the slurry tanks prevent settlement of the par-ticles and compressed air blown in at the bottom bubbles ticles and compressed air blown in at the bortom reasons up through the mixture, keeping it continually agitated. The sturry is pumped like water into feed tanks, from which it passes to the kilms. Careful methods of control in manufacturing cement

Carerul memons of control in manufacturing cement have of course been worked out by the cement plant chemical and physical laboratories, as the product is sold to conform to the specifications adopted by the American Society for Testing Materials, and the United

American society as a second process of apparatus relied apparatus relied apparatus relied apparatus relied apparatus relied apparatus testing coment, none is of greater interest than the 200-mean steve One of the requirements is that (Continued on page 143)



Where the Temperature Is 434 Degrees Below Zero

The Work of the Bureau of Standards in Liquefying and Freezing Hydrogen, Lightest of Gases

By S. R. Winters



HE LOWEST temperature ever recorded in Washington, D C, and possibly the coldest degree yet attained in the United States, was achieved recently when Dr, C W Kanolt of the Low Temperatures Laboratory of the Bureau of Standards

United States Department of Commerce, produced solid United States Department of Commerce, pulydrogen. The thermometer would have registered 484 degroes Fahrenhelt below the commonly accepted zero point, and only 25 degrees above absolute zero, which is 450 degrees Fahrenhelt Liquid hydrogen was manufactured at a temperature of 421 degrees Fahrenheit, the fluid then being easily transformed into flakes re-

sembling snow or ice,

Hydrogen—a gaseous element that is
coloriess, tasteless, odoriess, and the light est known substance—has heretofore been converted into a liquid and a solid. About a quarter of a century ago Sir James Dewar, a noted English physicist who died on March 27, 1923, first produced liquid hydrogen, and two years later he realized the production of solid hydrogen Dr C W Kanolt and his co-labo the Low Temperatures Laboratory of the Bureau of Standards, however, are probably the first actentists to achieve the dis-tinction of devising a method whereby both liquid and solid hydrogen may be dependably manufactured in quantity pro-

Uncle Sam is tackling the production of liquid hydrogen lends itself to the attainment of extremely low temperatures, and by extensive experi-ments the Bureau of Standards contemplates that this operation will be established on a practical basis. Second, these investigations have for their purpose the solution of difficulties arising from the methods of

manufacture, thereby facilitating the in-stallation and operation of hydrogen lique-flers in Government and university laboratories. A relatively small quantity of liquid hydrogen was first manufactured at the Bureau of Standards several years at the Bureau of Standards several years aby T B Fred, then a member of the staff of the Low Temperatures Laboratory are more than the Low Temperatures Laboratory amon machinery. Recent experiments, however, have been negotiated through the me of merly installed apparatus, and two liters of liquid hydrogen can be produced culty from the clogding of the much harry. The method of converting puscuss hydrogen into a liquid state is sunsewhat nanleguns to the process of munificativing states of, flary, in compressing the site of states, in compressing the site of liquid nir. Briefly told, this method con sists of, first, in compressing, approximately 200 atmospheres, or the application of 3000 pounds of pressure to the square inch. The resultant heat is displaced and the air is partly purified. It is then preterably, but not necessarily, pre-cooled to a point of a few degrees below ordinary or room temperature. The air is subor room temperature. The air is ausequently given passage through a heat interchanger and permitted to expand to atmospheric pressure through a valve. The expanded air is allowed to pass back. over the heat interchanger as a means of cooling the incoming compressed air Thus a negligible quantity of cold is squandered.

The apparatus cools until a portion of the air is transformed into a fluid.

air is transformed into a fluid. Rydrogen is lluented in smiler Rydrogen is lluented in smiler Rydrogen in the smile and the smi

of manuscrust, and the hydrogen. The slightest trace of the impurity of the hydrogen. The slightest trace of air in the inter will research the mechanism. This

air in the inter way, recess out solu air in the expan-sion valve and specify cloy the mechanism. This untoward circumstance may occur even when the hydro-gen seems to possess 100 per cent purity, according to the conventional methods of gas analysis. The absence of

As a standard against which to compare the freezing point of hydrogen, around which Mr Winters' story revolves, the following temperatures may be borne in mind Mercury freezes at Coldest weather ever observed in U S Coldest weather observed in world Alcohol freezes at Oxygen liquefies at Nitrogen liquefies at Vitrogen freezes at Oxygen freezes at Hydrogen liquefies at

Hydrogen freezes at Absolute zero, at which matter may cease to exist These temperatures, like those in Mr Winters' text, are in the familiar Fahrenheit scale, rather than the Centigrade that is ordinarily used in scientific work—THE EDITOR.

> extremely sensitive apparatus for making determinations extremeny seminive apparatus for missing determinations of the purity of gases is responsible for this condition Nitrogen is the objectionable impurity in hydrogen Thanks, however, to a process developed at the Fixation Nitrogen Laboratory of the United States Department of Agriculture, it is possible to analyze gaseous hydrogen at the different stages of its production and use

two-one-hundredrisa per cent of altrogen. The oxygin gaining admission into the generator is eleminated as a separate element by an apparatus that disponses a deficient beat to the gas to effect a combination of the oxygen and hydrogen. Any water present cent in the removed by common drying agents; and, in fact, the moved by common drying agents; and, in fact, the presents of a reco of water does not involve a surferes difficulty. The use of a device for were-time to the expansion which is the expension with the Respond of

ing the expansion valve in the removal or a plug of frozen air, in the event of clog-ging, was temporarily attempted, but in recent operations this auxiliary unit, has been discarded for the time being.

been discarded for the time being.

Liquid hydrogen is the lightnet fluid
known. The figure of speech, "light as
a cork," is thrown into discard, when
compared with the weight of hydrogen in
a liquid state. A cork, for instance, sinks a liquid state. A cork, for instance, sinks in liquid hydrogen because it is three or four times as dense as this fiuld. A container of liquid hydrogen is so light that one cannot easily detect the presence of it is present to be a contained to the contained to be a contained to be

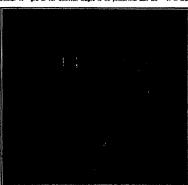
Dydrogen or air in a field state.

Once gassons hydrogen has resolved itself into a liquid, the transformation to a solid is only a single step and one relatively easy of accomplishment. The field is reduced to a lower temperature—approximately elseva degrees on the thermometer scale—by rapid evaporation of the liquid in a partial vacuum Solid hydrogen bears similarity to

a partial vacuum Rolid hydrogen bears similarity to fakso of snow and ice and they are extremely light It is difficult. If not well-night impossible, to preserve whydrogen in a wild form for any druntion of time. For example, Dector Essoil was creatory for a distance of four or five unless before the fisky substance molited, However, according to the method beat employed, it can be manufactured fairly raidely and dependably in quantities de-mand the state of the creation of the state of the state of the state of the creation of the state of the state of the state of the creation of the state o

cort.

Sit James Dowar, inventor of the well-known reseal that hears his mass, and the more received to the professional control of the profession in a surface of the profession in a surface of the profession in a surface of the profession in the Sir James Dewar, inventor of th



Dr Kanelt of the Bureau of Standards at the hydrogen Heneders, w

and locate the sources of contamination. For its own needs the fluress of Randards is manufacturing hydrogen by the silenctrylicits involude. This gainous washing the silence of the sile



Lefts How six permissis immissive are combined to make a wisely pushage where one would be quite innovables. Creater The problem of abliquing automobile time without looking the time or heater passes in set by possible them in a beaugustal box. Reful This extremely clear covine corries dat paids of eachy for majors in period country.

Trick based that was noncemary for long-distance shipping of merchandless of trick.

When the Packer Turns Inventor
A MONG the ancient proverbe there is one that tells
A us something about the advantability of cutting one's
author of this bit of sags autice did not know snything
author of this bit of sags autice did not know snything
about packing merchandles for adjournet. If he had,
and if he had had before him the examples of how to
preform this difficult insix which we see at the top of perform this difficult task which we see at the top of this page, he might have modeled his prover a little differently, making it have reference to the extreme advisability of building the box to fit the contents. All of us, presumably, can make a fairly presentable job of wrapping a bundle—just so long as the bundle

you or wrapping a number—just so long as the number preserves the shape known to the mathematician as a parallelepiped When the square corners make way to round ones or even to projections, and when the flat sides give place to eccentricity of outline, the difficulty sides give place to eccentricity of outline, the difficulty of draping the article in paper and string it vastly increased. And when, instead of paper and string, it must be draped in a wooden bux that will stund up against all the rigors of occun freight shipment, the shipping clock has a problem on his hands that calls for no little expenditure of gray matter

One line of attack consists in the use of boxes or crates with internal partitions or compartments. High voltars procediat Insulators are an example of the act of merchandles requiring such tentament as this from the packer. They are of awkward shape to begin with and breakable in the barquis! Insulated of typing to the packer. They are of awkward shape to begin with all the proceding parts of this crate, internal and external, in place and properly secured, the insulators are all fixed for a trip to any part of the world parts are the packet of the world parts and the proceding parts of the world parts are the packet of the world parts and the proceding that the proceding the proceding that the proceding that the proceding the proceding that the procedi Itage porcelain insulators are an example of the sort

serves in trouble. Ocean freight rates depend upon space occupied as well as upon weight; and if we turn over to the steamship a lot over to the steamship a lot of oddly shaped containers that easnot be economically stowed and that cannot be economica-stowed away, we shall have our freight bills in short Nevertheless, it is its to ship trick articles felt bosse, if we but them of such shape 715

land is indeed a problem for the packer. When he assembles six of them in the fashion shown, however with proper packing to hold them in their crate with out slipping, the difficulties of making a square package out slipping, the difficulties of making a square package out of a tapering circular one disappear immediately Simple as all these boxes are when we have once seen then, their simplicity is really much like that of the egg trick that helped to make Columbus famous, and their development required no little exercise of the in-

Marking Laundry by Machine

THE mechanical marking room of one of San Fran-cisco's large laundries, especially designed and in stalled, is the most mechanical marking room in the world This is because it has specially designed con veyors which convey the bundles to the operator, and also conveyors which convey the goods from the opera tor to the clussification room

The hundles are opened by the operator shown in our photograph at A. He stands at the deak at the end of one of the conveyors, which delivers the bundles to to the conveyors, which the bundle, write the mark of the list, and keep a record of all marks given our, so as to prevent duplicate marks. The hundry list is then put back in the bundle, and the bundle placed on the conveyor on shown at C, the bundles being conveyed toward the markers in the bootles, giving the

woyed toward the markers in the boolins, giving the T and T and T and T and T are constantly as a postal desice above at R and called a limit switch, which provides an attenuatin enheling of stophas and steringth enembed of stophas and steringth convergence where T and T are the branche of tolers on the conveyor when the branche of tolers on the conveyor T and T are the T are the T and T are the T are the T and T are the T and T are the T and T are the T are the T are the T and T are the T are the T are the T and T are the T and T are the T are the T and T are the T are the T are the T and T are the T and T are the T are the T are the T and T are the T are the T and T are the T and T are the T and T are the T are switch, the motor automatically starts up and drives the conveyor until another bundle comes in contact

with the limit switch when the conveyor will again

with the limit switch when the coursyor was again at support of the stepsed of the state of the left hand If it is a shirt the marker presses on the shirt key on the counting device, shown at B, marks the shirt and throws same to the take-off conveyor on her right, which is shown at 00, this conveyor delivering the goods to the classification room, from which point the goods are delivered to the waghing mar lila

When the marker finishes counting and marking the bundle in the number just described, she lays the laundry list on the table of the counting device and lifts the table of the counting device to contact with the type and the count is transferred from the machine

the type and the count is transferred from the machine to the laundry list. This counting device adds up the number of each article, something like the ordinary adding machine, relieving the nurber of this work. All articles in the bundle are bandled in this manner, with the exception of the last goods, table lines and dark colored goods, on which on ink mark will not obtd, or which it is not destrible to mark with an ink mark Goods of this class are hild on the top shelf-running the full length of the booths, at the left and shown at H An operator takes these goods from this shown at H. An operator takes these goods from this shelf and takes them to the muchine shown at K. She sews a patch on each piece of goods with this nuchiae then puts the proper laundry mark on the sewed-on patch with the power marking muchine shown at V. By combining these various converors with the mark-ing and counting devices, a great improvement has been

made over the method previ-ously employed, under which all marking of the laundry and all counting of the variand all counting of the vari-ous pieces and marking same on the laundry list was done by hand, with the aid of a single conveyor. The laun-dry industry ranks high in the application of inhor-say-ing devices.

Finland Hydroelectric Plant

FINLAND'S largest hydroelectric power station, Vuoksen Rapids, is well un-der way The total head is to be utiliz ed in four steps, to be utilised in four steps, the second being now under construction. When the plan is fully realised there will be a yield of 302,000 turbine horsepower, with a possi-bility of increasing this to 680,000 horsepower through controlling the water level



here the medicule that have been so encountril in the manufacture of automobiles are applied to the marking of laundry. The polyronce letters are appliched in the text

The Reconstructed Leviathan

She carries 4513 passes

Story of the American Effort to Render this Ship the Safest and Fastest of the Three Great Ex-German Liners

occutable in a few large hybratically operated scop-pers all of which can be cheed from the bridge When the "Lerdathan" was kander thermore, to person tockling of the buildands or their territic have octan additional has been provided and soft closes freeting to the back from 1 or recently was the six-ing of the water within a flooded compeninged purhave The control of the co



waterline Darlog the fifty Fastern: the call for spe-the gradual efficienties of tures witch the great or



A corner of the great medal last.

neutre 26 feet from Sec-

Women on the Farm

The Role in Our National Life of the Wives and Daughters of Agriculture

By George H. Dacy

ESPITE that the census classifies farm women under the heading "no occupation," these rural home-makers are among the busiest employed in direct agricultural business employed in direct agricultural trivilles or related lines of work. Daily their work leafus just an hour or so after deal in the state of t

tion along these lines obtains from a recent scientific tion mong messe mass obtains from a recent scientific surrey which has been conducted by the national De-partment of Agriculture. In cooperation with the state agricultural colleges and the county demonstration agents, Uncle Sam has attempted to learn first-handed wringer and like facilities as only one out of every 100 farms even has a mechanical washing machine. Usually she does the washing massisted either by human hands or automatic appliances.

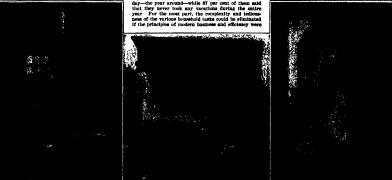
Generally when breakfast is ready, she awakens the rest of the family, dreames several children for school and prepares their lunches. When everybody's appetite rest of the family, dresses several children for school and prepares their function. When everybody's appetite has been appeased, the housewife has to wash the dision, feed the chickens, went he milt palls and cans, gather the vestrables from the gardan during the sunsative the vestrables from the gardan during the sunsative the winter for the subsequent monia. Them on all days except wash day, attention has to be derozed to the routine making of beds, filling and cleaning of lamps with mending and the broning to occupy all the extra time which she does not deverte to these sessitial tasks, much the contract of the

sweeping and dusting as well as the markening to attend to—all competing simultaneously with a couple of dozen other hurry-up jobs for the time of the farmer's wife. The national survey shows that 9000 of the farm women who were visited by Uncle Sam's representatives reported that they worked un average of 11.3 hours at day—the year around—while 87 per cent of them said

ery has curtailed much of the laborious hand work formerly associated with both field and kitchen tasks. Desgite all these easily available and adaptable facili-ties for improving general living conditions in the rural regions. Uncle Bant's survey above that the rank and file of farm families is still sadiy handlexped because they have not been able to realize basedis or this de-

exciption.

An inatters stand, the waste of rural womanspower such year is stupendous. Women waste valuable time in drudgery when with the assistance of some of the modern matchines, they could not only perform routine, mental islows much later and a less cost but they sow would have move time to devote to the more important own the second time of the world have move time to devote to the more important of the country of the second to the second of the second time class—were permitted to exercise more brain power and less brawn in their duity activities, their innare ability—aided by efficient household appliances and



Legi: Only one-tenth of one per cent of the farm women surveyed have hired help all the year around. Control the farm: Right-one per cent of these women care for the positry on their tarnes. Right: Shown Some of the results of a survey of the women on 10,044 typical farms

from the farm women, themselves, concerning the con-ditions under which they accomplish their daily distin-ced by the contraction of the contraction of the con-tive in 55 different northern and western states. The data were gathered from carefully selected, typical farming connunties in neveral of the leading equilibraria counties of each of these states. Most of the coulties covered contained from 55 to 50 from and

localities covered contained from 85 to 10 farms and into case of each section which was narroyed, a record was secured from every farm home in the neighborhood interspective of the size of farm, character of resource, prospectly of the farm family or associated conditions. This minute study of the duty change of the average colo, semantrees, laundress and surns to family personaling agent, producer of duty, gardes and positry products, teacher of her children and member of the local country clubs—If there are any. Her morning starts at few or six ofcock when he lights the littless of the contract o located anywhere from 10 to 200 feet from the house-many of these sources of water supply being without pumps. On Mondays she bests the sun up and draws additional water to wash the family clothes. She is not sided by an electrically operated washing machine,

applied to the homely work of handling the farm home. If the general run of farm homes were as well equipped us the ordinary dairy barn with labor-saving appliances, as he ordinary datty form with unor-saving appriances, the duties of the farm women would be materially reduced. Approximately To per cent of the farm homes reporting in this survey announced that they still used keroscie lamps—and these farms are probably quite accurate for the rural United States in its entirety. The installation of modern lighting systems would measurably lessen the toil of the farm wife and would make the rural home more cheerful and pleasant for

the farm family
There are some farm homes—but they are lamentably
in the minority—which qualify as satisfactory and
modern should and which cliniant the back-she and,
dradgery from rural cultury and houselessings purtremely minute—houses in Increasing the standard, of
rural living is apparent in all sections of the country
some homes in every community are divored from the
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some homes in every community are divored from the
some form the form the some property of the
community control have been productive of househand
sociability among country folks while notices mediti-

me in reveal houses 1 farms modern methods of management—would shable them to do better work in lose time than now in possible.

In the property of the property of the property of the country, at present, are yearning for modern lighting systems to replace the kerosane lamps now in use. Before lighting represents the property of the property of the property for the education of the firm handy as they the property for the education of the firm handy as they not be present of the firm women not only has to their could not be present of the firm women not only has to the property of the first of the firm women not only has to the present of the firm women not only has to the present of the firm to first or the firm of the first out-first o

A Denmy Aircraft Observer

THE dimber view of the common in Libe own field as a fright to ever is common in the compredecing areas, but for the first time a dummy observer is being comployed on aircraft. The seronantic marrenson section of the Duntel Street Department of Commerce, recently developed when the different commerces are described from the purpose of the War Department in performs by the Air Service of the War Department in performs the price of the War Department in performs. War Department in performance tests during aircraft

In testing an airplane it is essential to know the actual conditions that prevall during the performance server noted the behavior of the air-going machine subject to test, but obvious-ly there are limitations imposed upon the human eye in determining the action of

in occurring the action or the various instruments thus employed. Hence, the introduction of the dummy observer, which consists of a camera commonly used in the motion picture industry for photographing titles. Not only are the readings of for photographing itties. Not only are the readings or a series of alreraft instruments recorded simultaneously on a film, but the includen of a clock among the recording apparatus makes possible the indication of the precise time at which the photographic exposure

The motion-picture camera is directly driven by a small electric motor through a flexible shaft. It is placed opposite the instrument board in the fusilage of the airplane subject to performance flights. The of the arphane subject to performance nights. The selectric shortor, operated by means of a storage battery, is located within the reach of the pilot, whose com-nand of the dummy observer is reduced to the sim-plicity of turning on and off as which in the cockpit. As indicated by the photograph illustrating this article, the performance test instruments are compactly ar-ranged in a wooden box, including an automatic timing

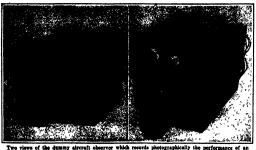
ranged in a woosen nox, increasing an automatic immig-control for the camera.

Preliminary tests of the dunniny aircraft observer by the Air Service at McCook Field, Dayton, Ohlo, in-volved the photographing continuously on a motion picture film atmospheric pressure exerted on the upper and lower surface of the wings of an airplane in flight, and lower surface of the wings of an airplane in light. Measuresments of these various pressures were recorded at the same those. The behavior of aircraft could thus be photographed in normal horisontal flight or in the course of turns, hope, spins, or other stants in the air in other words, this cancer visualizes on a film at specified intervals of time quite an array of performance test instruments.

mance test instruments.

When designing an airylane it has heretofure been extremely difficult to anticipate with any degree of accuracy the atmospheric pressures that the various parts may be expected to withstand. The aeronautic

instrument section of the Bureau of Standards, in adapting the motion picture to the role of dummy ob-server, seems to have solved the problem. The pressure distribution exerted upon the horizontal surfaces of the tail-radder, elevators, and stabilizers is obtained by connecting the atmospheric manuscre is obtained by consecting the atmospheric pressure instruments by pressure in the consection of the dispherape in the consection of the dispherape in the consection of the dispherape in the consection of the consection



mance test flight, the exposed films indicate the instru-ment reading, or the sir pressure at a particular point during any flying stunt which the pilot desires to throw the spoilight of searching inquiry According to the Bureau of Stundards, this novel

departure in registering instrument readings affords records that are more accurate than those obtainable

The Latest Motion Picture Outfit for Amateurs

A manteur motion picture outfit by which the amateur may take and project his own "movies" in the latest development of the leading American manufacturer of photographic apparatus Dr C M. Kennel Moss, director of the Estaman Kodak Research neth Moss, director of the Eastmann Kodak Research Laboratories, in making the amount-sweet recently at Franklin Institute, characterized hits an the most limited to the control of the c

said to be, relatively at least, as simple in operation as the usual locker more on contribution 170 factor where the first term of the first width of 1% inches while such picture or frame measures use centil view to %, as compared with the standard picture of 1 inch by %, as compared with the standard picture of 1 inch by a final. Five pictures on the small film consequently occupy the same length as two on the standard so that 100 feet of Cine Kodak film is sentialed to 20. that 100 reet of the kooks mm is equivalent to the fact of standard, and a 400-foot reel equivalent to the standard 1000-foot reel. The film is of the non-inflammable type and coated with a special enul-sion which enables the negative to be developed and then by a new process reversed to give a direct post

tive picture for projection.

The lens is an anastigment working at £8.5, permitting photographs to be made under poor light conditions. The finder is just above the lens and by an ingenious at inclinent changes the position of its times as the home. tion of its image as the lens is focused. In this way the is focused. In this way the image is shown through the center of the field at all times. The lens has a focusing lever carried through to the back which can be fo-

tive picture for projection

111

cused for any distance from infinity to four feet diaphragm control is in the left hand corner and can there be read easily In the center of the back is a foot-age indicator showing the quantity used, in feet The quantity used, in feet The crank turns nominally twice a second, taking pictures at the standard rate of 16 per second The camera is daylight loading, the film being

supplied in a special maga sine. After exposure the film is renoved in its magazine and sent to the labora-

tory for development.

The Kodascope, which projects the picture on the screen, is motor driven and is entirely automatic in its operation. Once a film is threaded the machine its operation. Once a film is threaded the machine requires no further attention until the reel is exhausted. For home projection a lens of two-inch focal length is used the picture filling a 30 x 40 screen at a dis-tance of 18 fect, and a 40 x 54 screen at 21 fect.

Why Is Tale?

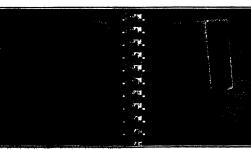
POR takens poorter, of course Bret that is by no means the only present the on this page—in the paper, as filling. More take is used in the page—in the paper, as filling. More take is used in filling the power of print paper than in canoninging good complexions. Take is also used as a filler for payer in the property of the property

strange to say, paint chemists found it improved the points for some purposes. Gally consistence had been aching in valia, but now achied because a higher price aching in valia, but now achied because a higher price and the chief teen that goes to make up the sules cost mostly laces, and the chief teen that goes to make up the sules cost mostly. Found in its natural state it is a rock. It is consistent to the properties of the sules cost and it is greatly to the measurable of the properties of

The best grade of tale is used for talcum powder, which must be white—except in the case of talcum for which must be white—except in the case of takeum for men, which has a flesh color. There is nothing in

taleum powder that is di comminuted rock and if talc is a kind of rock, then tal cum is only a kind of clean earth, to which boric acid is usually added to give south to note how many kinds of rock when broken up and crushed to the finest kind of powder, have the general semblance of talcum powder. although not the actual char-acteristics which are so METY

Not more than a genera-tion ago, when the use of talcum powders became very general, it was said the skins of the growing genera-tion would be ruined by its use. Yet the evidences of the eye say otherwise The processes the natural product go through before it is sed over the druggist's nter insure that it is the cleanest of all dirt



Projector for home metion pleative, the film districtual size, and the camera set up ready for action

What Is Color?

Something About the New Theories of Ostwald on this Important Subject

By Ismar Gusberg



IGHT IS ne of the many mani festations of energy. In order that it be pr i ed some other form of energy must be converted into light energy I'x uding the sun our greatest source of light we have two principal kinds of energy on the e ril which can be thus converted in the incundencent electric light or

In the incursors are electrical energy is transformed into light in the candle the hereverse in an or the gas the here is the humps is indirect in or sinal energy leng first course of late lest energy, and this to light. Direct nor in or of extraction in deep ricel energy into light is known but as in the 11 sph reversers of insect and bacteril life on us small scales are regards the resultant tenders.

I git i ves fr i pi ce i i lace viti great rapidity -s e 193 000 n lies per secon! This characteristic light al rea with certain of er types of energy such a radiant heat and ele tri al aves all such are ha was a liee twely as electron agnetic waves. In the passage it rough space filled as it is with all a rot of bodies if r is a of light undergo changes in direction and intensity through contacts with those by its and intensity through contacts with these by its faces. It row it is light back int the space from which faces it row it is light back int. The entrange from which have been all the light received no fat the reflected beam would have the same intensity as the incident beam would have the same intensity as the incident beam difference only in the disease. kn wn c liec ively as electro nagnetic waves. In it eir

fection is in practice never attained Bodies vary in the amount of light they Bottles vary in the amount of input they thre wheck into space according to the physical characterization of their reflecting surfaces what is not reflected in absorbed or swallowed up increasing the temperature of the body or being other-wise converted

temperature of the body or being otherwise convrided to the converted of t

given color sensation

We find it convenient to divide the visible spectrum

to divide the visible spectrum

and the sensetion calling these r wave-length range into aix sections calling these rel range yellow green blue and violet When sunlight in which no wave-length are missing atribes rel range yellow gross blue and violet When smithit in viole to wave-length are missing arithmetology at these color to represent a second and the second and the second are related to the second and the second are reflected, we see the nes that are and of a use and the second and the second and the second and violet rays I we been absorbed and the red reflected. The second and the red results are arbeited and the red results are already and the red results are arbeited as a second the results are consistent and the red results are arbeited as a second the results are consistent and the red back areas with the bright all gradations are possible, and we have a continuous series, with black at one extreme and shading down through raysy that white at color can vary from another in the percentage of black

and white that it contains When two such graps are mixed we get a new gray brighter than the one and duller than the other and for which a place can be found in the series. Hence this series of duit colors is

uni-dimensional Black has ordinarily been called "no color" and taken to denote the absence of color Libertin, which open point control of all oil n, may also be colored to the object constituted of all oil n, may also be colored to the color of the co light We often hear of a whitest white until a whiter one comes at any and displaces it from its position of e linear The same fact holds good for black. But inamuch as some white n ust be taken as a standard of comparison a choice must be made of the whitest white Pure barium sulfate is accordingly taken as the 100 per cent perfect white, the white which reflects all the light ti at strikes it

From a practical standpoint it is equally incorrect to state that black don tes absence of all color For one black is blacker than the next and the blackest one black is blacker than the next and the blackset black which is assumed to have no color at all may be f und t possess some slight trace of color when compared with another new black. Furthermore as the eye is not absolutely perfect and as its sensitivity is not infinite absence of light as defined by the sense tion produced in it, is relative only lives the despast black would exhibit traces of color would reflect a

COLOR we here with as always without it the world would indeed be drab and spiritules and human psychology quite different from what it is Every new theory which seeks in anywer our provided of color or to perfect the classification and recognition of the numerous colors is weithy of sirease consideration and study. When such as new idea is propounded by a wall-known scenata tike Dr. Withom Ostroad the German chemist is instruct and importance or doubly cortem. The numerous discussions published since he first advanced his color beary in 1911 are sufficient evidence that this flavory a contribution to sur-possibility of the contribution o

little light if our eyes were sensitive enough to de-

that it is a critically evident that all the colors of the gray series can be easily distinguished from one an other by their brightness in other words by the per-centage of light that they reflect, based on bless fas-cinativities and lightfrings from the color that re-facts for per control of the light striking it. Such a color is white said is made flow the pursue free cample gray 60 is the designation given to the color that re-facts for per control of the light striking it. Such a color is white and is made flow the pursue size code Gay and the color of the light star of the color that ra-lation of the color of the light star of the control of the 30 per control of the light may be considered as white. All pursues the color of the spectrum night head at the indi-tract the control of the spectrum night head are in andi-that these, too, constitute a uni-dimensional series. The last is however that instructs of several efficients

The continuity of the spectrum night has for in mar-tat these, too, constitute an undifferent are Te-fract these too, constitute an undifferent and the fact the however that universe of several different wave-lengths unmally produce a color semantice of a travellength unmally produce a color semantice constitute. It was not to the color to the color to the color of the different from that given by any shapes wave-place, and vary them by mixing them with one earlier it says vary them by mixing them with one earlier it says combinations, we may mix it with any given step, set the white-cryst places seein. Plantly herital optical the two colors, one briefs and the says of the says of characteristics and dominations of the stright soldies in far from the simple matter which it is in the charac-neries.

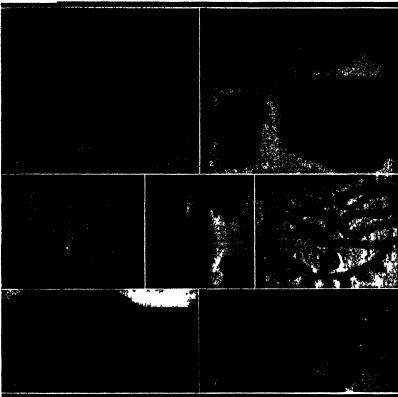
is the reuse two seasons to the fact that the reit shaloss to orange from the reit shaloss to the reits, cromps the yellow sett at on their things to the violet. Not all of us, perhaps, here restlining the

algorithments of the further fact (that vision size he bles into red. This resulty steads that the speciment may within it was a steady of the speciment may write it is agreed out by the ordinary predia to by relabley. We can break into this clock or "Stage" outre as any color waterwar and spec distinct stages over waterwar and spec distinct stages are started to color clock with the parents printing started the color clock of the parents printing so times of congast or grows, and if thereast the black to take him first to grows, and if thereast the black violet for and compalisated to the congast or grows, and if

the content of the co

determination that is open and the rein to see the second of the secon

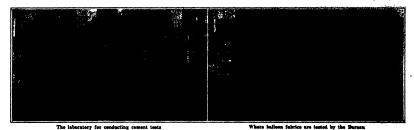
SCIENTIFIC AMERICAN



notives in jeweiry the same as we n is have Egyptian jeweiry of modern individualities. In indisposable hand sufficiently has proved to space the level for intermediate tables proved to space the level for intermediate condition and seed of careful to they were in help condition and seed of careful to they were in help condition and seed of careful to the level has the careful translation of the

Abraham was horn at at 2000 years B.C. and at that time Ur was situated a the Peretan Culf. But since that time the huphrates in a criving down count shit to throw the auxient if it far inland. It was a great nortifine on p runs end ying a lant, commerce. Because of the control of the contr

UE OF THE CHALDES! THE BIRTHPLACE OF ABBAHAM



Uncle Sam's Question-and-Answer Office

The Bureau of Standards, and It's Bearing upon Everyman's Business Problems

By S R. Winters

OW can the dentist determine the wear and tear on false testit, what amount of energy and the state of the st and how can a business man apply a motor-driven letter opener in speeding the clearance of his morning's

mani)
No, this is not a list of conundrams for mere speculation or factitious pussies for firedde fancies. Rather,
these were definite problems explored and solved recestly by the National llureau of Standards—and these
and six of 124,088 tests by actual count, more or
less sulfafactorily conducted during one year By less militatetorily confined during one year By chashfeation, 11,068 scientific observations were made for the government and 14,200 for the public The partially attributable to the extigated of var For-instance, it was imperative to develop a sound ranging device for the location of a three-sinch battery, three miles away, accurate enough to fire Civillan problems could wait solution.

could wait solution.

Now the battle flags have been furled, the question arises how can the individual, the manufacturer, the business man, the investor, the scientific society, public utility corporation, and the numleipality avail themutility corporation, and the numicipality avail them-selves of the practical utilization of the Bureau of Standards in solving their knotty, every-day problems? Popularly termed, this government bureau is capable of applying the yardstick and the ther-numeter to American factories and in dustries—with the ultimate results of

dustries—with the ultimate results of climinating waste, facilitate precision in science, and obtain high utility in prod-ucts of industry by indicating an attain-she standard of quality Paphaps millions of American citizens have never heard of this brunch of the U.S. Department of Commerce—there-

fore, a paragraph as to its location and ganisations is not amiss. Not altogether dissimilar to the college

that chooses rural scenes for its campus as a way of removing its students from the temptations of the white lights of the city, the Bureau of Standards selected city, the Bureau of Standards selected exclusion as a guarantor of freedom from mechanical disturbances and witestions. Three and co-scial rules from the Wilde Investigation of the Wilde Investigation of the Performance of the Performance of the Performance of the Performance of Freedom of the Performance of Freedom of the Performance of Freedom of the Performance of The

stants, standards of quality, standards of mechanical performance and standards of practice. The public, however, can best visualize its capabilities and oppor-tunities of service by briefly nanumarizing a few of its

archievements in 1919 me and upon the despectation of the State and muscle state and muscle state and muscle state and muscle state and the state of achievements in 1919

Telephone service, the bugaboo of utility commissions and public alike, is the object of extensive investigaand points aure, is the object of extensive investiga-tion. Street railways and electric lighting companies also bring their problems to Washington for solution. A A three-wire power-distribution system was suggested and adopted by the street railway company of Wil-mington, Del. Recently the Bureau was wrestling with the problem of corrosion of the lead cable sheaths of

the problem of corrodics of the lead cubic sheaths of me electric company in fit. Load in the only "allitude inheratory" constructed in the United States. The small room, with reinforced-concrete walls, is strong cought to withstand the pressure produced on the cought to withstand the pressure produced on the cought of the contract of the contract of the cought of the contract of the contract of the low as one-third atmosphere. A wintion engineers are here testing the units of mechanism operating under conditions permitting of careful sectific measure-conditions permitting of careful sectific measure-

ments. A device has been developed for measuring the rate of altitude on an airplane.

The Medical Service of the War Department and the

ments. A device has been developed for measuring the rate of attitude on as airplane. The rate of attitude on as airplane. The partners and the greatel public are using 20 no-termed rare sugars. The library is conducting investigations that will ultimately directions scientific data on the rare sugars. The library is conducting investigations that will ultimately directions scientific data on the rare sugars. A controvery has articate between layer and select—the Bureou of Ratadards has consumed to set as effective. A device for determining the density of molissees has been developed—the value of the product of the products from foreign countries. Cooperating with a product a from foreign countries. Cooperating with a product from foreign countries. Cooperating with a support of the first of the

identified with the Bureau of Standards for 70 years, and since 1913 has served as Chief of the Metallurgical Division. High temperature measurements is the outstanding admittife contribution of Dr Burgass, he being the author and trans-lator of a nephes of books on this sub-foct. His capacity for organization and leadership is responsible for the present Division of Metallurgy at the Bureau of sons. The newly installed director of branch of the government service jus-bility received the silver medal, and Bureau of Binndards was the seign of the gold medal from the Painnes-Pa-Exposition of 1918. The herivities of Division of Residency range from paying, methal; said central of, for related to the service of the re-traction of the service of the re-traction of the service of the re-traction of the service of the service of the related to the service of the service of the related to the service of the service of the related to the service of the service of



Sixteen by twenty-four inch reliers used in the metallurgisti division, for studying the effects of mechanical working upon matelia



1. 2: lower and upper halves of indicator body 2: which 6: arrows for holding halves together 7: and for indicate halves together 7: and other forms of the forms washer spars-body gasdet. 18: intendeting wires. 19: small siring sparshold gasdet. 18: intendeting wires. 19: small series 19: adjuster for connecting small tube to larger tube Assembly at the spark-plug for carrying the entrements of the indicator.

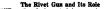
For Learning Engine Pressures

For Learning Engine Pressures

A HIOH speed indicator suitable for messuring pressures in gasuitie engines or other units of mechanics and a superior of the suitable suutable suitable suitable suutable

a rotating contact of ona-half degree and another con-tact which can be set at any desired angle. The coordina-tion equipment has two parts, the electric circuit and the pressure circuit The former is composed of a series of connection, battery, telephone receivers, timer, and indicator. The latter consists of a source of gas under pressure and a source of vacuum, with valves and gages for supplying, control-ling, and measuring the pres-sure applied to the top of

the disphragm. Under operating conditions, the pressure and the angular setting of the timer can be varied until the phones indicate by the cessing or beginning of the cilcking that the point has been reached where the pressure and be single correspond to a point in the engine cycle. The pressures and corresponding angive are picted to form the observations. the diaphragm. does not make a complete diagram for an individual cycle but is used to measure the pressures in consecu-tive cycles at certain consecutive points in those cycles, by building up an average diagra



THE rection of a large steel skyeraper is a familiar Light to most city dwellers and all visitors to a city such as New York have been interested spectators. One of the usual sights is the delivery of hot rivets by the of the usual slights is the delivery of hot rivets by the river bacters to the erections of the reter furnace work, the rivets are usually thrown or tossed to the workmen by usuals of tomes and the box become very destination and the rivets are lost, while sectionis in which workmen on a lower level are struck by a failing rivet are sorare as to be a cause of suspicion when they do occur and the rivets are sorare as to be a cause of suspicion when they do occur and the rivet are sorare as to be a cause of suspicion when they do occur and the rivet are sorare as to be a cause of suspicion when they do occur with the cumbersome unchoid of delivery. It is known as a "rivet gam," and with its use the lanarda known as a "rivet gam," and with its use the lanarda.

gnown as a "river gan," and with its use the material of river handling are reduced to zero.

The illustrations show the component parts of this rivet-passing outfit. They consist of a compressed after tank, a foot treadle mechanism to release the sir, a compressed air inde shown at the right side of the tank, a head or body into which the river is inserted, metal tubing for transmitting the hot rivets and a receiver into which the rivets are shot at the other

The gun and the forge are conveniently local an out-of-the-way place and the fuling led to the job. As each rivet is heated and read; to be passed it is set by the hester on a valve provided in an opening contained in the head of the gun. The rivet opens this valve by its own weight and enters the machine. The valve recloses automatically and the rivet is sent on its journey simply by pressing the foot tweader. The latter journey simply by pressing the foot trendle. The latter operation releases the compressed air, which has been supplied to the tank, into the head of the machine and speeds the hot rivet through the flexible tubing. The

rivet is shot into a receiver at the other end, where the holder-on removes it with his tongs and inserts it in the

The rivet gun has a dis-tance capacity of 125 feet de-livering rivets up or down at the rate of 50 feet every three ageonds. It is claimed that the gun has even exceeded this performance, shooting rivets 180 feet in nine and a fraction seconds without submaterial reduction in temp ature

One of the outstanding ad-gantages afforded by this equipment is that it eliminates the necessity of placing mates the necessity of placing river torges in closed com-partments, keeping the fires and their tunes out of closed places to the benefit not only of the riveting gang, but also of other workers there. De-livering heated rivets to relate of commutes different



Enlarged view of the delivery end of the rivet gun

work in inaccessible places and passer boys are not needed. As to air consumption, data furnished would indicate that this equipment does not materially in-crease the total requirements of compressed air per rivet on new construction and a substantial reduction in rivet passing costs is claimed Prevention of a high tage of accidents in bridge building and stru iural work caused by faulty rivet passing is also a feature. The equipment is particularly adaptable to building steel masts in place.

Composition, Purification and Certain Con-stants of Ammonia

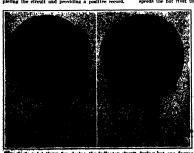
SEVERAL years ago at the request of the refrigera-tion industries, the Bureau of Standards undertook to industries, the liureau of Standards undertook an extensive investigation of the properties of anhydrous animonia. Upon the results of this investigation will be based the compilation of accurate tables for engineers use in designing and studying the operation of refrigerating machines.

All of the properties necessary for such a complia tion have now been determined within the range of pressure and temperature ordinarily encountered in practice. The most refined physical measurements have practice. The most refined physical measurements have little real value, however, unless assurance is given that the material used is of high parity. The necessary information on this point is contained in Scientific Paper No 465 on the "Composition, Purification and Certain Constants of Aumonia," which has just been

Analyses of a number of standard American brands Analyses of a number of standard American brains of commercial ammoula now upon the market indicate that they are more worthy of the designation "chem-ically pure than many of the more common chemical reagents. Tests conducted at this Bureau showed that most connercial ammonlas contain less than 0.1 per

cent of impurities.

This paper can be purchased from the Superintendent of Documents, Government Printing Office, Washington, D C., at 10 cents a copy



the graint timer for closing the indicator circuit during but one degree of the cruis and at a producerained position of the crushshaft



Getting rivets on the job without plucking them

A Readable Manual of Seismology

OT until sixty years ago did earthquakes become the subject of exact in villation and seismology is really so

the embert of exact in visuality and in the property of the pr

of the crust. The instrument generally known as a setsmograph is the pen with which the carthquake is made to write the story of its life fit; us it read. One of the earliest forms of this instrument was Babbage's howl of molasses a shock caused it; field to clumb, one side of lasses a shock caused it; fluid to climic one sage or the bowl and the position of the stain indicated roughly the direction and extent of motion. In his illuminating chapter or sectionographs by Daylson re-solves them into their basic components describes the way in which they work and pictures representative instruments of today

lastruments of today. The vibrations are compiled. There is usually a displacement of the ground assessment of the ground

forts have been concentrated on recording the hori sontal and vertical movements of the ground, even here no single seismograph is sufficient, near and dis-tant disturbances require differently constructed to-

struments.

Three parts are essential to the seismograph the steady mass a certain point or line of which remains at least theoretically, always steady the frames or support from which the steady mass is suspended, and the recriberal extent of the steady mass is suppressed, and the recriberal extent of light that magnifies the displacement, and insertive its record on a drain the displacement, and insertive its record on a drain the steady of the steady of the steady of the steady of the steady insertive to these any oscillations into the steady mass may acquire. The principles accompanying drawings and both mechanical and photographic methods of rujetrations are explained. Of the many different types of vibrations occarising in a greet extrapolar, some other our between the steady of the includes an extension of the principle of the experience. In a great earthquake, none citied our or observation by reason of the smallness of their amplitude others by the laught of their period Generally we first become loader faint but rapid tremore like those caused by our hypothesical sepress trips at not too close quarters, are felt sound and treasors soon merge line when the comparison of the compar

of known dimensions.

Some earthquakes are accompanied by noises that resemble a roaring wind the boom of a beavy gun have a seen of the control of the cont

"In the major, with these passersprings, for a distance or more than 600 roles, and the indistance of more than 600 roles, and the indistance of more than 600 roles, and the indistance of the

A Sugar-Coated Dandruff Cure

A Sugar-Cented Dandruif Cure

DISUIDING a dandruif crue as a mark beauty
stack is a new way to combat a disease that, scording
to Dr Vincent Oxy of Forest Hills, M V, is making
us a nation of 'bend servicions." The uniform from
portance than he had suspected when he jearns that
the scientific name for it is 'festorines Sics," which
makes it appears to be a really sections matter "Aller

makes it appears to be a really sections matter "Aller

makes it appears to be a really sections rather "Aller

"The section of the section o makes it appear to be a really sections matter. There are numerous bloories to secount for dandrull but once have been given the seal of finality by the medical pose have been given the seal of finality by the medical pose of the seal of the seal

has been discovered that an important part is playe has been discovered that an important part is played powerful celemical agent is the internal secretions. It seems quite possible indeed that the substances pro-tor of the body for the relevation re-sette may operate upon the same physical principle upon which is based near our stimulation. On the other hand it seems certain that the chemical coordinations resulting from the action of these servicious differ in some respects from those produced by the nervous system. The latter are former are show there have no the result of the action.

indistantaneous and offer of overy about curreits. The termination was still been are the result of the action for reagants which must be carried by the blood to re-mote parts of the both and continuous since their relationship to the continuous since the

mon embryologic orden, which are later widely dif-regulated freezants because the control of the freezants with the control of the control of the interest and diverse when we also done to compare namerous and diverse when we also done the compare of the control of diverse we attention to the thermal secretions throughplaths entire series of animals, and particu-larly gif-given found in the invertebrates.

The complex operations and the interplay of the cross and the interplay of the place when the interplay of the cross asken but more recently it is not because of the organization and it is not the case so far noted glandest and carried to all parts of the organization and the interplay of the cross asken but more recently it is not more applicable wholly through the treat asked the property of the cross so far noted glandest and carried to all parts of the refreshell asked and carried to all parts of the the internal parts of the property of the services of the thread several of the property of the services and the interplay of the property of the services of the thread several of the property of the services and the services of the post that the services of the services

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Various Arts and to Patent News



Semething New in Speedometers DOSSINITATY of improvement in the speedometer has perhaps not impressed itself upon the average driver, but the product set being materied by the control of the control of

ment may be set for any desired speed, and then locked or left unlocked. In nest may be set for any desired speech, and thus hecked or left unlocated. In two or three miles of the indicated page, the signal light at the right will final, and if the acceleration then cost and in the acceleration the glatton is cut off. If the fight has been locked, there in no scene from the light if the the cost and in the co

dialed figure, and at this point the cuival will go out will start the engine, just as in the point of the control of the control out which will be set to be set to be prevent this, the dist may be left wat looked, and dermed beck to zero as the cut-out copies the set-to.

This suggests a further of the set-to.

This suggests a further of the set of the set out of the set of



Gravitation Truly Constant

MORE than one investigator has been led to the conclusion that the New IVA led to the conclusion that the New-tonian constant of gravitation changes slightly as the attracting bodies are heated. In the Proceedings of the Royal Society for October 2, 1822, Messrs. P. E. Society for October 2, 1922, Messra, P. B. Shaw and N. Davy, who had previously noted an increase of gravity with rise in temperature, now report that with improved suspension arrangements the difference dissupears. This probably has a wider significance than would appear from its mere application in correction of the authority previous results. The of the authors' previous results. The SCHENTIFIC AMERICAN has always ex-pressed the opinion that observed vari-ations of the gravitational constant as a function of temperature, or pressure, or of the chemical constitution of the gravitating bodies, have been due to ob-servational errors or inadequate data.

The One-Hand Grease-Gun UBRICATING the automobile with one hand is the latest thing, made possible by use of the grease-gun illustrated herewith "A ton of pressure" is the manufacturer's claim, but he does Making the Chauffeur's Cigar Harmicas

WE once brought down wrath upon our head by suggesting that a cigar lighter on the dashboard of the modern automobile was not enough of an absolute necessity to ju stify the car n into necessity to justify the car manu-facturer in setting it down as one of the major sales points of his latest model. The reaction of the manufacturer of the lighter was substantially to th that we were the only automobile owner in the world who did not smoke, and in the world who did not smoke, and that our viewpoint was accordingly a frightfully distorted one. So we illus-trate with studiously neutral comment the device that makes it possible for the the device that makes it possible for the chauffeur to smoke without putting out the eyes of his passengers. No, on further consideration, we withdraw this neutrality in favor of emphatic endorseneutrally in ravier or emphatic endorment. For we have driven 100 niles beadle a persistent smoker, and arrived sightlews at the destination. The device illustrated consists of a gause cylinder that is fitted about the cigar, and prevents ashes and sparks from flying about. In all sectionness, it strikes us about In all seriousness, it strikes as a highly sensible scheme.



neglect of the third and higher powers of the perturbations. The model is a sort of hybrid of the Bohr and Languagr sort of hybrid of the Bohr and Languair models. It may be approximately de-scribed as the projection of a sine curve, on a barrel-shaped surface of revolution, the two electrons always being on oppo-

The chemical stability of helium indicates a very simple and symmetrical arrangement of its pair of electrons, but arrangement of its pair of electrons, but all the models possessing this property now appear to have been tried and found wanting. A reformulation of the quantum conditions is one alternative and the conditions is one alternative and the author considers severed of such. But he finds such one precluded by Incom-publishity with experimental results. A. Severe of the property of the such as a 1921) concludes that the spiral tracks of beta particles indicate the field of an electron not having the spherical sym-metry required by Coulomb law, and he suggests the heta particle acting as a magnetic doublet as we'd as an electric charge, but if the hellum electrons did so act, their strength, to reconcile the calculated ionization potential of the model, would be quite incompatible with modes, would no quite incompatible with observed molecular magnetic moments and would invalidate the classical theory of X ray seattering. Crowther and Schunland (Science Abstracts, 1320, 1922) suggest that some modification of the law of force at very small distinces, either between two negative electrons or an electron and a nucleus, appears to be demanded by their experis scattering of beta particles.



Reducing the grease-gun to its simplest terms

not specify whether he means total or per square inch. We assume that he means the latter, and that the true conmeans the latter, and that the true con-tent of the claim will be duly appre-ciated by every prospective grease-gun user The tool seems a decidedly usable and workmanlike affair A single fil-ing is said to be enough to lubricate the ordinary chassis two or three times, but now many grease cups the "ordinary is" is conceded to carry is not in

A Filling Station for Fountain Pens

WHAT do you do when your foun-tain pen runs dry at the most in-convenient possible moment—as it all ways does? If you are a student at the University of Chicago, you patronise University of Chicago, you partonise the nearest filling station, the campus is supplied with these quite as freely as is the Lincoln Highway with filling sta-tions for the tourist. A penny in the alot operates the machine, and emplies slot operates the machine, and enables the owner of the most voraclous pas to appearse the thirst of his instrument. The machine works with self-diling pans and with the old style that alls from a dropper—provided the user has his own dropper. The dropping of the oofs and the turning of the handle releases ink from the reservoir, and the fulfil flows. the turning of the handle releases ink from the reserver, and the fluid flows into the right-hand well, whence it can be spicked up by the plin itself or big the dropper. A slot in the upper jeft-hand corner of the outift contains a wirper with which any damage dules by spilling or shopping may be required. If one drink prins out slot enough, a secopid pancy will, of course, turn the frield.

The Normal Helium Atom and the Quantum Theory

Quantum Theory

A PTER a brite critical survey of ex
I string quantum theory models or

normal belium, a study is made by J H

Van Vleck, in the Philosophical Magazine for November, 1022, of the model
suggested by E. C. Kesnibe (Science Aisurvers, No. 1003, 1021), in which the
aymmetry, the one symmetrical type of
which the one expunsational type of
which the onerry had not been comsymmetry, the one symmetrical type of which the energy had not been com-puted The mathematical analysis, necessarily laborious, was rendered greater than in the case of an astro-nomical orbit, owing to the relatively large perturbing forces of each electron upon the orbit of the other. It occupied about six months and is reproduced in all essential details. The checking of the accuracy of the calculations by the test of constancy of the energy of the system, commonly used in the astronousical case, would here have involved the extremely laborious calculation of the coefficients of the various periodic terms of the Eugene extraordery of the the coememon or the various periodic terms of the Fourier expansions of the kinetic and potential energies. A much easier method was furnished by the fact that in motion under the inverse square law the average absolute value of the potential energy is twice the average binetic energy. Since the average value is simply the constant part of the Fourier expandon, and since a power series de velopment is unique, the coefficients of velopment is unique, the connectuan or ilke powers of the parameter must be identical if the computations are correct. There is shoulte agreement in the first three terms, while the small errors in the fifth decimal place in later terms are insignificant, and due mostly to



THE proverbial collar button may still take first prise as a champion in losing itself under the dresser, but the cap of the tube of shaving cream has made a rival record as one of "life's





A mica condenser for radio work, of

down the lavatory utlet Man had to devise something better to save his temper and the result is that the manu-facturer of one brand of this daily tollet necessity has put it into a tube whose screw cap is hinged as well You can t lose it unless you mislay the entire tube For further convenience the cap is de signed so that it may be hung upon the wall by a little acrew book which ac

The Lightning Change Screw-driver

THE question of having the right tool at the right time has been partially I at the right time has been partially solved by a western manufacturer who has produced the very ingentous maga sine acressfriver illustrated. It is absolutely a new idea and a de-

parture from the usual magazine screw driver in that the blades issue from the driver in that the bindes issue from the church into the working position without leaving the magnation. It contains three sizes of bindes that are designed to give it a wide range of use. The bindes are always contained within the magazine and are not removed consequently they are not lost or misplaced as is the case with most momentum, we delivers.

are not lost or misplaced as is the case with most magazine acres driver word is that the blade principle of this new two list fact the blades are indexed to correspond with mumbers on the shell and the operator is always sure of getting the right blade but any the shell and the operator is always sure of getting the right blade but simply holding the destend number up when tipping the tool as indicated in the litteratural.

This new tool will be found useful by mechanics muchinists carpenters sportsmen electricisms automobile own ers and in fact anyone who ever uses



A Giant Condenser

A Grant Concenser

O far as is known the single-unit
is the largest in the world. It has just
been completed by the manufacturer for
use in one of the Government radio sta
tions. It has a capacity of 0028 microfared at 90 000 voits with 1855 kvs. It
is of the oil immersion type. The tom. is of the oil immersion type. The top insulator is of percelain and the high tension terminal projects from it
Condenses of this general type have

been made by this New York concern for a me time but the one shown is the first of its size to be manufactured Similar condensers will shortly be in Similar Cindensers will shortly be in extensive use in connection with power factor crrection for lightning protec-tion and for other uses. Becent reports are that the installation of this con denser has increased the station of ficiency by 10 per cent

By way of comparison the gentleman standing at the condenser holds in his hand me of the same companys con densers as ordinarily employed in radio receiving As may well be imagined the enorms us difference in size introduces manufacturing problems that are by no means easy to meet

Can-Openers of the Month

TRADITION has the lock nut and the garment snap as constituting the most fruitful field for invention when measured in mere numbers of patents We have expressed at one time or an other a suspicion that the monkey wrench and the combination utility tool were close competitors and it just dawn upon us that another implement in which the scope afforded to ingenuity practically without limit is the can opener We illustrate the remark with

two examples
One of these at the expense of a little
more space than is usually taken up by
the cun opener does what we have not
seen d me before—it actually holds the
can while it opens it This in a way
supersedue the safety can-opener, because



The non-skid can-opener

the only reuson why the average house-wife cuts barself on the can is that the latter slips in her hand. In addition this openor cuts the whole top off clean leaving a smoothly turned edge. A left hand turn of the crash opens the ma chine for insertion of a can and a right hand turn performs the decapita tion. The apparatus occupies space-but, no more than the less-used men

but no more controlled and the controlled and contr

An Outside Micrometer with No Moving Parts

THE latest micrometer instrument is of a steel tape design. It measures diameters from 2% to 5 inches by thou-

sandths of an inch. It does the work of a micrometer calipse, though instead of reading declinals, it gives direct read-ing in thousands and fractions thereof. For instance if an article should meas-ure \$3175 by the micrometer calipse; this instrument will give a direct read-ing of \$5/16 plus five thousandths. This ing of 8 h) to bus me thousandns. This is mighty handy to the mechanic who is not well versed in decimals. The graduations are quite legible as they are about one-eighth of an inch apart. This about one-eighth of an inch apart. This is possible, hecause while they represent diameter measurements they stand on the circumference and heater are more than three times as far apart as the corresponding marks on an ordinary straight value would be The tape is wrapped tightly around the object with the two scales abstitting such other The one piece construction diffinities to talk you have been presented as the construction of the construc adjustments Being so compact it may be easily carried in the kit or pocket, and requires no adjustment in use



The easiest way to get into a milk can

Plating with Cobalt

Practing with Cobsis:

DROBABLY the newest development
in electroplating is the deposition of
cobalt Becently announcement was
made of the discovery of a new process
for electroplating with chronium, but
the cobalt development is still more recent A few years ago some canadian
rewarch workers in the Canadian Demanustric of Minea created considerable. rewards where in the Canadan Department for Mines created considerable interest by putting forward a proposal to use cobelt as a metal for electroplating in the place of nickel. The results of these researches showed that cobalt could be deposited on brass iron, cobait could be deposited on brans iron, steel copper, tin, German silver lead and Britannia metal and that the deposits were firm, adherent hard and uniform and could be readily polished to a satis-factorily finished surface. The cobalt deposited was harder than the nickel and the speed of deposition considerably greater It was also claimed that its revistance to corrosion was definitely suresistance to corrosion was definitely su-perior to that of nickel, and that the deposits stood satisfactority all the usual bending harmering and burnishing tests. The actual weight of cobair required for a good coating was stated to be about u quarter that of nickel I is possible to electroplate with cobait quits actis-tocordit and were reside, but it is my factorily and very rapidly but it is un-

Better Picture Frames Through a New Vise

New Viles

New Viles

Frames may have passed away, but

frames may have passed away, but
there are thousands of multiple frames
being sold to the hundred of the old style
frames. In art about the making of
prames in a ris about the making of
prames in a ris about the making of
business and the frames going through
re ranging in size from those to carry
post cards and smaller motions to onto
the are several feet in each dissumston,
and the modding used varies from a fraction of an inch in thickness to system

outless maximum speed, especially shoe

universe maximum speed, especially shoe



New and ingenious idea in the micromoter field

the prices do not justify high costs. In nailing the smaller moldings there is more danger of ruining the job or putting the corners toom her to meetle factory way than there is in making the

frames of the larger molding
During the war one art dealer had to use so many green amployees that he invented a special vise that enabled a green girl with little practice in driving a nail to turn out in a half day more

green girl with little practice in driving a sail to turn out in a half day more worth the second of the second of





Small electric drill of axtra

Electric Drills and Utility Tools

Tille range of electric drilling and general utility tools is amply demonstrated by the two units which are illustrated at the top and bottom of this trated at the top and bottom of this column. At the top is a machine de-signed to fill the demand for a bench drill that could be depended upon for absolute accuracy and extreme sensitiveassociate accuracy and extreme seaminve-ness. At the same time it is adaptable enough to be used on many kinds of work. The motor is dynamically bell anced, and runs equally on direct or alternating current. A bull thrust bear-ing takes up all end play, and wicked grease cups insure positive lubrication. grease cups insure positive lubrication Perfect concentricity in the drill is had by carefully grinding the gripping joints of the cluck jaws. Quick-acting locking devices make the raising and lowering of the motor or work-table a simple operation. The work-table is rack-and-pinion operated, and easily controlled by the operator's hand. A depth gage regphilon operates, and came the operator's hand. A depth gage regulated by a thumb-screw prevents the drill's going too deep. The balance of the table and its graving is such as the same than the same the tame and its graing is such as bring drill breakage to a minimum with the smallest and most delicate drills. "Perfect control, case of operation, and wassen adaptability" are the claims inade for this machine, apparently with good reason.

ane check guard, which permits grip-ping the hand-piece close to the work, can be removed with a single turn. All together, this tool seems a fair match for its brother in efficiency and all around adaptability



The stanted furth of all tools

Better Tire Chains for Next Winter

MONG the things that every auto A mobilist knows are the compara-tively short life of the cross links of antitively short life of the cross links of anti-skild chalins, and the unsatisfactory action of the clips that hold the side chalins together. Especially if one is obliged to drive over alternating stretches of country road and concrete, the former beling in such shape as to demand chalins while the latter is sub-stantially clear, one finds that the claims demand chains while the latter is sub-stantially clear, one finds that the chains do not stand the gaff. Replacable cross-links, while conserving the undamaged side chains, are really a begging of the question And who has not had to stop in dirty weather to unwind a chain from the axie, about which it has been per-mitted to fall and entwine itself by the opening of one of the clins?



New style of cross link that gives longer life to tire chains

We illustrate herewith the latest devices of the chain makers to overcome these drawbacks. The new style of link offers a far greater amount of metal to the road at a given instant, and hence should last far longer And the new should last far longer And the new clip not alone closes and locks more positively than its predecessor, it also makes it easier to bring together within clipping distance the two ends of a clipping distance the two ends of a chain that is just a flager's breadth too short to go around the tire easily. This latter advantage, bowever, is a collateral one beside the positive locking frature, it will be plain that the clip actually hooks around livedf, instead of depend in our parties of rivides or spring ten ston to hold it closed.

Motion of a Sphere in a Rotating Liquid

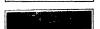
SPHERE of uniform density is su A SPHERE of uniform density is sup-posed to be suspended in a uni-formly rotating liquid of the same density An initial relative motion of the sphere parallel to the axis of rotation is set up by an instantaneous impulse sufficient only to effect a small disturbsumment only to effect a small distribution ance in the motion of the system, small motion being defined to be such that the squares and products of velocity and verticity components may be neglected in the expressions for acceleration. The in the expressions for acceleration. The initial disturbed motion of the liquid will then be irrotational, since the effects of potation in the control of t will then he irrotational, since the emects of rotation take time to develop. Now the pressure intensity of the liquid con-sists of two parts, one depending only on the distance from the axis, and the on the distance from the axis, and the other on the disturbed motion. When the disturbance causes the sphere to move parallel to the axis of retation, the disturbed motion of the liquid will the disturbed motion of the inguid will continue symmetrical about a line through the center of the sphere parallel to this axis, and the motion pressure of the liquid will also be symmetrical of the liquid will size be presented to the liquid will size be symmetrical about this line. The resultant effect on the sphere will, therefore, be to produce an acceleration parallel to the axis of rotation, canning the sphere to continue its motion parallel to the axis of rotation, and its line of relative motion and its line of relative motion.

may be called the axis of the sphere. It is found most convenient to assume the existence of this particular type of me existence of this particular type of motion, and then to show that all the conditions can be activated by making it a particular function of the time, a perfectly definite mathematical problem, pervectly demnite mathematical problem, the solution of which gives the following results. The sphere oscillates about a point on its axia, the distance of which from the initial position of the center of the sphere is proportional to the velocity of projection, the amplitude of oscillations rapidly approaches zero, but the period summerches a constant value oscillations rapidly approaches zero, but the period spureaches a constant value half that of the undisturbed retation of the liquid A general expression is ob-tained for the velocity, at any point, re-ducing to simple expressions in particu-lar cases, which are examined in the paper 11 appears, however, that the gradients of the velocity of the liquid over the equatorial plane of the spl and of the transverse velocity along a meridian of the sphere ultimately in crease without limit, a stage being reached after which vorticity comporeacted after which vorticity components cannot be considered small, so that the solution will represent the true state of the liquid only for a limited time. The question of the ultimate physical state thus remains unanswered. J Proudman has shown that a small steady disturbance is impossible, but G I Taylor distributes is impossible, but G I Taylor obtained a solution of the general equations of stendy a numerical motion about a rphere, which does not satisfy the equations of small motion.—Solence Abstracts, 626, 1923, based on paper by S = U Tance, Proceedings of the Royal Society, 102, pages 89 111

Research on Edible Gelatin

A NOUNCEMENT is made of the establishment of a Fellowship in the Mellon Institute of Industrial Research of the University of Pittsburgh,





Partly open, open and closed positions of the new chain clip that hooks posi-tively instead of depending upon fric-tion to keep it closed

for the purpose of ascertaining the real food value of edible gelatin in its man-fold applications in the American dietary. The founding of this Fellowship is the outgrowth of the desire of the gelatin manufacturers to uphold high stand. manufacturers to uphold high stand ards in the manufacture of this food and to have available for their own use and for the trade data of scientific and technical nature respecting its advan-tageous use in the food industries.

In addition to experimental inves gations, a correlation of all available gations, a correlation of all available facts reparting subito gestata will be made, to be held at the disposal of all users and prespective users of the prod uct. The present incumbant of the In-dustrial Fellowship is Dr. Thomas B Downey, who will be glad to turnish any available information to those interested in the uses of edible gelatin.



The newest substitute for the h

Exit the Hose-Reel

SOMETHING for simpler than the hose reel is offered the amateur gardener in the clip illustrated herewith gardener in the clip tingstrated herewith For moderate lengths of hose, much less space is occupied by a hose looped on itself once like a hoop fastened by the clip, and hung on a pog, than by one reeled up in the old fashloned manner

Periodic Annual Variation in Pendulum Rate

COMPTES READ DUS. 175, pages 748-779, gives an account by R. Goudey of observations on a pendulum in the Besancian Observatory This pendulum of observations on a pendulum in the Resuncts Observatory. This pendulum is in a ground fivor room exclosed in a double glass case, so that the temperature varies slowly, but wariations of at mospheric pressure are felt. It appears that each year this pendulum rans slow beginning about April 11, that from that date until September 1 threads and the pendulum rans and the p that, subsequently, the pendulum n at its mean rate until near the en the year The movements have been established by curves plotted for twelve different years they cannot be explained by changes either in temperature or in by changes or as the result of chance Whether they are a peculiarity of this pendulum, or may be looked for in other instruments, does not appear

A More Sensitive Radio Rheostat R EXENTLY there was placed on the market a radio rheostat with greater automatic features than have been offered heretofore. It gives the most precise control of filement current, inasmuch as the range which is cov-ered by three-quarters of a turn to three complete turns on most instruments, in-here spread not over 40 full turns of the knob. This does away with a messessity for half-s breadth adjustments are supported to the support of the fire-prior resistance tubes are connected in serties by a micronecter-operated silder, the length of wire in the circuit depending upon the location of this silder At "rail on" position the device prossessor practically serve creations, and complete turns on most instruments, is



Radio resistance member that quires no minute adjustments

it gives a uniform change with each full turn of the knob right up to its reast num. One full turn of this knob, it is claimed yields a finer adjustment than the hairs breadth change on the more faultiar rheoatuts.

A Flexible Ruler for Drawing Curves

Curves

O'th of the in st ingenious drawin, instruments that we have seen is she in to in by dermain humator Walter Armin of the Armin ing curves. But it is made of a phasic and chasic material, so that within due limits it can be best further around, or straightened further out to give a series of related curves of varying degrees of flatness or sharpness. The degree to of related curves of varying degrees of finances or sharpness. The degree to which the shape may be changed without causing the instrument to buckle up from the flat surface of the drawing is indeed surprising—Herr Arndt has sent us sam ples and we have verified this for our selves. Yet it is stiff enough to hold its shape against the pencil pressure

Ohm's Law at High Field Strengths

If is customary to regard the motion of learn bite i ms very skw and the author investigates the problem as to whether the velocity will grew preportion aiely to the force f r much strenger fields and those usually emityed; i # does than a fase still hold valid Learn from the strength of the square of the field strength of the square of the field strength. The suff r is of the opinion seconding to the square of the field strength. The suff r is of the opinion stitution demands as a vyerimental proof fir I Learn's conclusion is heave the present investigation. The difficulties attending the measurement of the resistance of the strength of t ately to the force f r much stronger fields such high fields (100 000-volt/em) are considered and the method of surmound-ing them given in detail. The paper con tains several diagrams of apparatus and data curves. The solutions employed for the measurements were of sodium chir-ide sufturic acid and sodium chirolite containing 47 per cent of cane-super with which to increase the internal friction of which to Increase the Internal friction of the solvent From the results obtained the author concludes that up to field strengths of about 500.000-001/cm Ohms law remains valid only up t 1 per cent and he claims to have established a qualitative confirmation of the Lenard theory—Science Abstracts barred so paper of M Wies Physicolische Editing 22

The Electrified Wash-Day
MONDAY and Tuerday will lose much
of their terror for the bousswife M of their iteres due the bousevith through the more general and prion of washing drying and ironing mechinery and a typical example of what hevestore and a typical example of the anti-ventore page. This assembly is designed to operate on the continuous-run principle One surnout at a time passes through its White the second article is in the drying third through the in-run and so not the end of the family wash if the machine is more integrity maximally directed than acone of an ortage for the use of the operators arrangth

strangth . The dryer is so constructed that the air is beated immediately before intake is a gas bester and radiator or electricity may be substituted. The dry hearts air is foresed along the bottm relief a through the clothes and sear the left end to the top, whence it is again forced downward through the creating exhibes by the hot air agitable operated by the com motive



A complete electrically operated wash-day outfit that washes, drice and ires the clothes in a continuous run, or that can be used for any one or two



This drawing stencil of hard but flexible material makes it pecable for the draftsman to draw numerous curves of different radii with the one instrument





The juggernant that converts a rough right-of-way into shape of a single operation, the claws at the front blocking up the growth of the properties of the properties of the properties of the properties.

then properly. In safelling there are tested from suches safe dies. The stocks from suches safe dies. The binnelse, tree, and the lim, stellen of moth, etc. The gas heater in the may also be used for heating het. The trees, electrically operabilised intended to the steller steller, and the intended to the two tested in the heat. It carries a stationary does giving the operator a place to when straightening out, taking both giving the operator a place to when straightening anything that is not good to the steller, and is not given to the stationary and the steller, and is entirely assistany. A is of galvanised sheet steel, heavily enum-elled, and is entirely sentiary. All the gears are enclosed. The washer is oper-ated electrically and is similar to those on the market. Either of the three units

Four Draftmann's Tools in One
TVHE draftman is the third photograph
I on this page is using a single naturement that taken the place of four The
possibility of the straight page in the page
potentior. The straight page is the page
potentior. The straight page is potentially
to stand the same
is Tegare is self-originat. And the same
in Engare is self-originat. And the same
confinantly rendered by the compose.
This is effected by a simple device. The
furtherman is left hand is above, grauging
the board on the under side, is exactly
in line with the senie along that fisces and
and down upon the rules, carrying a little
and down upon the rules, carrying a little
and the set had senies of the Test
and the set that the sole is the side of the
and down upon the rules, carrying a little
and down upon the rules, carrying a little and down upon the ruler, carrying a little ear that projects across the ruler's edge, and that is provided with a hole for the peacil these up along the ruler edge with the pivot point. In this way an accurate the prot point. In this way as accurate radius may be struck and the swinging of the arc follows easily. Incidentally, the sero point on the percretoric size in itse with the pivot point and the peacil point enabling the same to pivot the instrument and lay out angies with extresse

A Giant Plane for Subgrading Our Roads

THE business-like fundion in which the Third beamses—the highlen in which the I read-eather of today goes about pre-paring the site on which he is to lay his parameter is not before the spen in grighle style by a glassic at the sub-grader Has-machine is such a list, heavy still a such these such a listing high plan it has to you

The Service of the Chemist

A Department Devoted to Progress and Achievement in the Field of Applied Chemistry Conducted by ISMAR COMMERCO, Chemical Engis

Electricity to Be Generated From Dry Gas

A grant has a proper to the minimum of the minimum

New Paper Stock: Cypress Pine
THE West Australian Forest Products
Laboratory has amounced that the I Laboratory has announced that the wood of the oppose pixe, a tree which is indigenous to Queensland, is suited for the pixel of the p

ervation of Fish Nets

Preservation of Fish Nets
A Spreas of Fisheries the effection
A Spreas of Fisheries the effection
A Spreas of Fisheries the effection
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and pishe. After the nets have been dipped has the tan liquor it is well to
tensing method the nets are left ten
dipped has the tan liquor it is well to
the preservative powers of the tanning materials,
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such as a s tion in this way se well as cotton threading but not to so high a degree. Finding the next is the principal method used in the United Biston. It consider simply storing the access tar and then par-titly drying. This is a very effective method as the coal tar used is an anti-tuitly drying. This is a very effective method as the coal tar used is an anti-tuitly drying. This is a very effective method as the coal tar used is an anti-tuitly drying. This is a very effective method as the coal tar used is an anti-dox against particular, the coal a good preservative and causes little shrahaga. The principal objection to to use for that it weakes our too readily, or eregaristic from the not.

Gaseline From Coal

Genetics From Coal
A COGENTIO to experience that
A here been made in Mantahun, Gentainty, the Genemics have recorded in
making assortine from coal. A report
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But Demantage Prison Old Rubber C 12 yeaher, work out inter tribes and the little rary to used in the composi-cial time for you want to the com-position of an about in me control section and then beated in me when you want to the composition of the prison of the control beated to the composition of the composition of the little is addition. On years which has been been as the composition of the composition of the little is addition. On years we have

dation due to exposure to air, is used dation due to exposure to air, is used preferably, as it produces a superior product Old rubber which contains such substances as zine oxide, suifate of barium, lampblack, etc, gives good

A thick, heavy liquid substance is pro-duced by the fusing process, which is no longer rubber but which is of very no longer runner out water is or very heavy consistency, highly adhesive, of a waterproofing nature and capable of adhering strongly to surfaces and of forming a frictional coating on them.

New Protective Agent for Animal Fibers

Fibers
A NIMAL fibers, such as wool, silk and
Are substances such as leather and skins
are protected against the action of alkalies in their finishing and treatment
processes by means of a product, known
as Protaktol, which is prepared from
suifite collinione waste liquors. This
represents just another way in which
these liquors can be put to good use.
For burther default the reader is rebert for the processes of the product of the protage of the product of the product of the protage of the product of the product of the protage of the product of the product of the propared to the product of the product of the propared to the propared to the product of the propared to the propared to the propared to the product of the propared to the propared to the product of the propared to the pro
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pared to t Vol 54, page 1551.

Making Artificial Egg Substance A SUBSTITUTE for white of egg and A yellow of egg is made from fish roe, according to a German process, which is patented in German Patent No 842,508. The roe is first extracted with fit and lecithin solvents, such as alcohol and lectifits seivents, such as attoched and ether, and then after the solventis have been reserved by evaporation, the sub-been reserved by evaporation, the sub-stances remaining are treated with a codor of egg yellow. This mass is then mixed with protein substance or the protein residues obtained in the extra-tion of the sin co. Philadrum, precipi-tion of the sin co. Philadrum, precipi-tion of the sin co. Philadrum, precipi-ciant in the service of the service of the earth, is used as a catalyst in the ju-dration. About 60 billograms of egg sub-stitute can be obtained from 100 kilo-grams of codish rea.

Durable Stain for Woodwork

A NEW German patent, which de-acribes a process for making a dur-able stain for woodwork is as follows: able stain for woodwork is an follows: A solution of one kilogram of commer-cial deep brown stain (Cassel brown, consisting chiefly of alkali humatas) in 30 to 40 parts of water is filtered and 30 to 40 parts of water is filtered and heated to boiling, and about five liters of a two per cent solution of ferric chloride are stirred in, in a thin stream, until the mixture will filter easily and until the mixture will filter easily and the filtrate shows an excess of iron. After decanting as much of the liquor as possible the remainder is passed through a bag filter, and the solid registhrough a bag filter, and the solid regi-due is dried on porous clay plates, or in a vacuum, until the paste, mixed with a little ammonia, forms a stain ready for use. This stain scales well into the wood, and on evaporation of the six-monia becomes insolvable through the decomposition of the complex fer

Metal Linings by the Spray Freecas Freecas as surfaces in order to predice metallic coverage of metals on surfaces. In order to predice metallic coverage present time it has not given the most snoomatic results. The contings that here been obtained hithere's have been obtained things of a porum character, which is a deciently understathe proparty in residents residents.

linings for chemical apparatus. It is now claimed by the German company, known as Metallizator A. O of Altona that thoroughly satisfactory till. lead, aluminum and copper limings can be pro-duced on iron by subjecting the sprayed metal cust to a finishing process, which metal cust the subject of the customer of the customer of processing the hausening. The notice or both The lining may be rendered more coherent by hammering. The proce may also be filled up with some chemistry estimation material, for example, in the case of lead lining with lead sulfaste obtained by treating, the lining with all furic acid. The great advantage of these sprayed linings over the usual laid-on ones lies in their class centract with the underlying numbering, which is an important of the latest contract with the contract with the contract with the contract of the contract with the contract w -Chemiker Zeitung, Jan. 11, 1928.

New Oil Seed From Gold Coast THE nut known as Kiridwe can be I used to good advantage as an oil seed. The oil content is about 44.2 per cent of the entire weight of the nut The fat could probably be used as food and in the nunufacture of soap. The and in the manufacture of soap The removal of the shell, which is thin and which forms only about 88 per cent of the weight of the nut, should not present any difficulty. The residual mars, after the extraction of the oil, noncesses a bitter taste due to the tannin contained in it, and hence is unantiable for exitie food.—Bulletin Imperial Institute, XX,

Building Stone From Caster Bean Refuse IN England a building stone for in-terior purposes is made from the refuse that is recovered from the ex-traction of caster all from the easter

Asphalt Vapors a Moth Killer TIBSTS have been made in Generating to determine the effectiveness of asphalt funce as a moth killer. The suphalt is vapors and the vapors are allowed to enter a wall-closed room, where they expert their destructive action on the moths.

Sulfur Dioxide from Sulfates

WHEN alkaline earth sulfates, such as sulfate of magnesia, lime and VV as sulfate of magnesia, lime and streamlurs are miles with iron and then heated to the proper members and the milita is decomposed by the iron with residue in the milita is decomposed by the iron with residue in a substantial properties of the control of the sie, volume 125, pages 337-848.

Uses of Zinc Dust

A interesting list of the uses of size.

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vat colors, (b) the property of precipi-tating metuls from their solutions, in purifying sinc sulfate solutions for electrolysis or for the manufacture of lithe pone. (c) the property of combining ture and of giving with moist air a basic carbonate or with sea air an oxychloride which protects the metal from further which protects the metal from further oxidation. These properties have led to its application in painting iron objects, sheradizing (that is, immersing iron ob-jects in ainc dust at a temperature of 300 degrees Centigrade), galvanising cast iron and metallization (that is, deposi-tion by projection of a layer of zinc on the surface of a metal) Zine dust is on the surrace of a metal) zinc dust is usually obtained as a by-product from since smelters, but it is also made by hlowing gas against a stream of liquid zinc or by grinding. Such dusts contain varying amounts of impurities, some of which are undestrable for certain uses. Microscopic examination has shown that the grains of sinc dust consist of metallic globules coated with crystals of sine ox-ide which prevent the globules from

The Use of Aluminum Vessels

A CCORDING to an article which has been published in the Zeitschrift fuer daz gesamto Kohlensauro Industrio, volume 51, number 20, aluminum voca volume 51, number 20, aluminum vessels are particularly well suited for the manufacture of light colored incquers and varnishes. The color of the product is not affected when the manufacture is carried out in these vessels. On the other hand, sluminum is very sensitive to organic acids. When aluminum vessels. to organic acids. When altuminum was-sels are used for cooking or distilling in the factory and for cooking food in the household, the interlor of the pots and pans and factory apparatus become coated with unstrances which cannot be removed by the ordinary methods. Hence the following composition was devised and was found to be very effective in removing these decoults from the inving these deposits from the inremoving these deposits from the in-terior of aluminum utensils. A solution is prepared containing 90 parts by weight of technically pure crystalline sulfate of alumina and 10 parts of soda crystals. The aluminum vessel is filled with water until the dark colored spots and places are covered. About one to three teaspoons of the above saline mixthree tempoons of the above saline mix-ture may be added to the water in ac-cordance with the size of the vessel. After the water has been brought to the boiling point, it is found that the deposit on the aluminum has been entirely

Bio-Chemical Engineering

Bio-Chemical Engineering
CIVING credit to U P Steinmers for
CIVING credit to U P Steinmers for
and Metallurgical Engineering asks editorially, and answers in the affirmative,
the question whether the above words
define a new profession of importance.
It is pointed out that biology is coming
to hely more and more see is to be a coming It is pointed out that biology is coming to play more and more a role in our chemical problems. The expansion of the sugar industry through attention to the intensive cultivation of the plant, and the suggestion that the biologist, through the intensive production and the economic utilisation of alcohols and charge forms of plant mercey may also the economic tunisation or accords and other forms of plant energy, may solve the fuel problem, are cited as evidence of the place that blo-chemistry may come to fill in the general engineering struc-

The Heavens in August, 1923

Measuring the Minute Heat Radiations Received by the Earth from the Stars

By Professor Henry Norris Russell, Ph.D.

If F cold month, it is a commonplace of literature and with good reason. Though the cold of the cold of the cold of the cold of the season—those of the mean produce not the least those of the mean produce and the least the cold of the of our eyes are exquisitely sensitive to light while those

of our eyes are exquisitely sensitive to light while those of our skin are but crudely so to heat. No artificial appliance can begin to compete with the eye in sensi-tivense to light—units indied we were something like the photographic plate which adds up the cumulative the photographic plate which adds up the cumulative action of hours. But it is very case to make heat detect ing instruments incomparable me, sensitive than our cutameous nerves. With such devices the heat not merely of the moon but of the stars can be detected and Observatories and as Pettit and Nichels a have done more recently and in like manner at Mount Wilson

The heat measuring device is very sim-tle both in apparature, and in theory. Two tiny wires of different metals meet in a little disk blackened to absorb any radiation which falls n it If this juncof which it forms a part is unaffected an electric current will be set up which can electric current will be set up which can be registered by a sensitive galvanometer Various metals differ in thermo-electric power and by a suitable choice such as making one wire of bismuth and the other

power and by a saltable choict such as a maining one wire. I beautin and the cheek contained the saltable salta mount so tiny and fragile an affair

mands great manipulative skill

The slightest breath of air blowing past
the junctions would cool them more than
a star could heat them. So the whole a star could heat them. So the whole apparatus is put in a glass tube exhausted to a very high vacuum. The window on this tube through which the startight en-ters must not be made of glass but of form the control of t

How the Observations Are Made

All this care would be of no avail were not the electrical instruments equally sensitive. Here fortunately, this instruments equally sensitive riere instruments, the astronomer has the advantage that sensitive galvanometers are used in many lines of actentific work, and can be obtained commercially. The deflections of the time suspended magnet are read as usual by reflecting light from a mirror that turns with it. If the the time suspended magnet are read as usual by re-flecting light from a mirror that turns with it. If the mirror is of very good optical figure the scale can be placed as much as twenty feet away and good results still obtained. We han instrument will give a deflection attill obtained. Such an instrument still give a deflection of two millimeters—very easily observable—for a current of a millional part of a millional period and an accordance. This gas of the basewest is a room proteined from changes of temperature. The wires o man ting it with the received temperature. The wires o man ting it with the received temperature. The wires of man ting it with the received temperature. The wires of man ting it with the received temperature. The wires of man ting it with the received temperature of the protein the such as the man time of the protein the such as the protein the such as the protein the protein

When all precautions have been taken and the ap-paratus is in good order—as the writer saw it a few days ago;—it works like # charm The hundred inch

telescope is set on the star and the observer looking through another window at the back of the vacuum cell, sets it first upon one and then upon the other of the junctions. Meanwhile a second observer in the basement connected with the first by telephone records

namement connected with the first by telephone records the readings of the galvanometer. In practice, this is done photographically on a plate moved slowly downward while the spot of light swings back and forth across it. It is extraordizary to watch nace and forth across it it is extraordinary to water it shift regularly back and forward as the star its set on one or other of the two junctions and to realize that the energy which moves the image actually comes from the star For in this case there is no terrestrial source the star. For in this case there is no terrestrial source of electromotive force set into action by a relay the star own heat supplies the power. Calculation shows that less than one fifty thousement part of the heat received from the star is turned into electrical energy and this low efficiency is almost unavoidable for the rise in temperature of the heated junction is little ever a testil of a degree even for the brightest stars.

At \$76 e'cleck Aug 20

on are in Standard Time When local summer time is in of not be made one hear inter; 12 o clock on August 7 etc NIGHT SKY: AUGUST AND SEPTEMBER

and for the average star is much less even than this. and for the average star is much less evan than this. The heat meaning device in its present prefection, adds a new and very important weapon to he among of the astrophicals and we may expect to hear much thing more it is found that stars of different spectral types. The is of different emperatures give very different amounts of heat in proportion to their light. For the same brightness, as observed by the eye the bottest stars send us the least torul heat and the cooled cross the most. This sounds every extraordinary until ones the most This sounds very extraordinary until we turn the thing around and say that for equal amounts of total heat, the hottest stars give us the most light—when we recognize at once the factor of luminous efficiency familiar to everyone who understands why a tunguten lamp which runs at a higher temperature than its carbon predocessor, saves half our lighting

What It All Means to the Astron

This bids fair to give us the best means at our dis-posal of estimating the temperatures of the cooler stars. For example Alpha Brouvetules, a red star of what is called Class M, gives only about one-fifth as much light, in proportion to its heat, as most stars of its

sort, and hardly one-fiftieth as much as a white star-like Vega. This indicates that its surface temperature must be much lower-perhaps 2000 degrees as passed as 3000 degrees for an ordinary red star like Antares This was shown several years gab ph Cobbetta The Mount Wilson observers have recently from much more neutriarbide vesses among the bong period variables commended to the star of the star period variables ordinary red stars. But near minimum, when their light may drop to less than one parts of the heart. control of the fort hear institution, the completules with a light max drop to less than one per cent of the maximum brightness their heat is still perhaps con-sixth to the naticinum amount filter of this sort, invalidation to the saked eye may send us more best than Vaga. In the control of the saked eye may send us more best than Vaga to the national than the control of the saked eye may send us more best than Vaga. The limit of the value of the national value of the saked eye may send us more than the for a white star This indicates relatively very low tentified we have plook upon these variable stars then white star than the looks which perfolicitly and for rescales all in known out of the perfolicitly and for rescales all in known out of the control of the

fraction of the whole
Further work with this new and powerful instrument of research will tell us
much regarding the temperature conditions of the stars and of the moon and
planets too

The Heaver

Turning to our usual star-gasing, we find Cygnus right overhead—the swan being fairly easy to imagine flying north eastward down the Milky Way, with his outstretched wings extending into the darker sky on each side. Along the galaxy to the northeast we find Cepheus. Casaloto the northeast we find Cripheus Cassio-pels and Pressus to the southwest, Aquilla Ophiuschus, Bagittarius and Scor-pio (setting) 1 Ar is west of the senith, with Hercules Corosa and Bootes below Drico and Ursa Minor are above Ursa Major all being in the north northwest Pegganus is well up in the sent with An-dromeda on the left, while Aquarius and Capriccoraus are in the dull southeastern

The Planets

Mercury is an evening star this month, but is south of the sun and is easily seen in our latitude. Even at the end of August when he is furthest from the sun,

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The Motor-Driven Commercial Vehicle

MAJOR VICTOR W PAGE, M S. A. B

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles

Stocking Crushed Stone

THE accompanying photographs show the method used in building high stock-plies of crushed stone for highway purposes on Illinois duy-lator construc-tion of pavement, under the supervision of the superintendent of construction H. B. Jay Three-ton-capacity dumping body trucks were employed to haul the aggregate from the railroad, and by use of portable runways or tracks up which the trucks ran and dumped their loads, niles were easily built to a height of fifteen feet. The runway sections were de-signed to be of such a weight that two men could handle units in placing them in position and taking them up and moving to other set ups.

They were constructed in ten foot

cial fittings where gream or solidified oll is to be delivered. A moment's work suffices to inbricate each part of the

New Cushion Tire for Trucks

PROMINENT tire company has announced the details of construction its new "aircore" cushion tire for trucks. Produced in the full and double cushioned types, the new tire is designed to provide displacement spaces located on both external and internal points to accommodate the flow of rubber when under pressure The company, pointing out that the solid tire tends to buige out at points in front of and at the rear of the area in contact with the road, asserts that the external spaces, in the Variable Length Springs

I's recent British truck the semi elliptic rear springs have front and rear anchorages rendering them stiffer and augmenting the carrying capacity with increasing load, and vice versa.

The rear ends of the springs, themselves of almost normal design, are anchored to shackle plates as usual, though the plates project rearwardly at an angle of approximately 30 deg from the horizontal instead of being almost vertical with "no load," as shown in accompanying illustration. Above each spring end the frame brucket has attached to its under neath surface an inverted curved slipps which, as the spring becomes defi with increased load, forms an abutment for the end of the top leaf, progressively shortening the effective length of the

The shackle plates merely serve to locate the springs for the latter come into contact with the slipper almost imme-diately the first portion of the load is put aboard. The slipper is separate from the actual bracket, being of case-hard ened steel and renewable Grease cups are provided for the contact surfaces of are provided for the confact surfaces of silipar and spring as well as for the shackle pins. At the front ends the slip-pers also appear, though the shackles are absent. The accompanying sketch shows this scheme, which, while of ben-eft with quarter and buff loads of merchandles, especially fragile goods, sho chandles, especially frightle gloods, shows to greatest advantage in connection with passenger transport vehicles which are upt to be lightly loaded at some times and heavily loaded at others.



A New Type of Rail Car

THE accompanying photograph shows a gasoline driven rail cur recently delivered to the Hetch-Hetchy Ruliroad at Groveland, California. This car has

Details of the design by which the springs are automatically length

better traction secured by suspending the motor on coll springs direct over rear axle on one end of a sub-frame at-tached to the main frame

The sub-frame makes one-half of a complete truck as it has a swivel bol-ster built in the main frame so that it will turn at curves, thus eliminating flange wear and relieving side thrust. It is said that the car rides as well in the rear seats as in the center The car complete weighs but 10,400 pounds and makes eight miles per gallon of gasoline. The same principles may be used in con-struction of stages and omnibuses to run

A Large Tractor Trailer Outsit

WHAT is regarded as the largest pressed-steel drop-frame semi-trailer that has ever been built is 48 feet long over all 8 feet wide and 12½
feet long over all 8 feet wide and 12½
feet high from the ground to the top,
and is built to conform with the State
of Michigan's trailer law, the maximum



Gasoline rail car with power plant at rear

many new and distinct features. It seats thirty passengers and is built for either narrow or broad gauge railroads On the Hetch Hetchy Bailroad it negotiates a five per cent grade, twelve miles long. with numerous 80 degree curves, with numerous so degree curves, at speed of 27 miles per hour The Hetch-Hetchy Bailroad have been operating gasoline motor cars for the past six years and this car it said to be more efficient than any of their previous

By placing the motor rearwardly of the driving wheels all revolving parts in front of rear axle are eliminated, thereby permitting a very low hung car, and all motor noises and smoke or gasoline odors are at the rear. The passenger seating capacity has been increased without lengthening the wheel base and

limit of which is 60 feet. This trailer limit of which is 60 feet. This trailer was designed to haut automobile chassis to South Bend, Indiana, and to bring back from South Bend automobile bodies. On each trip out of Detroit is curried five large chassis and on the return trip brings back 24 open automobile bodies in the contract of the large chassis and contract trip brings back 24 open automobile bodies patient and updointered The largest freight-are and handle only from 10 to 18 hodies. The accessive freight rate on this class of commodity enables this trailer to handle 24 bodies for approximately one-half of what it would cost to transport them by rail. The bodies in this trailer stand up end-wise and are held in position by steel and wood frames so that they hang clear of the floor and do not rub or touch each other They are brought into the city of Detroit free from dust and scratches.



Pile of crushed atone, as built by dumping motor truck

units of 4x4 stringers to which were nailed two-inch planks, making the tracks slightly wider than the tires. On top of the plank 4x4 guide ralls, or curbs, were bolted, so that the trucks would stay on the runways. Each tenwoun may on the runways. Each ten-not unit was attached to the next one by means of three-quarter-inch iron hooks and eyes, and fastened together laterally by the same method. All units were interchangeable.

The Lubrication Problem

MORE and more attention is being given to correct lubrication of mo-tor vehicles, for it is realised that no class of machinery requires more thor-ough lubrication. Various systems for supplying oil and solidified oil to various supplying oil and solidized oil to various parts of the motor truck have been in troduced of late. The most popular is in the form of a modified grease gun which is provided with a flexible hose and coupling for attachment to the spe



form of specially designed notches cut in the side walls and tread and the central hollow ring or core surrounding the base band of the tire, will take care of this "flowing" tendency The notches not only furnish displacement space but also a sure-footed truction in all weathers. a sure-footed traction in all weathers. In order to prevent the accumulation of stones or caked mud in the notches or vents, pebble ejectors, in the form of a step-like formation of rubber lugs, are ided in each notch.

The principal cushioning ability of the "aircore" tire, however, which permits deflection under load equal to that of normally inflated pneumatic tire, lies in the use of the central hollow ring which is in the shape of a continuous ring of a spear-shaped cross-sectional opening The advantage claimed for this type of cushioning is that the rubber dis custioning is that the runore displaced merely follows the easy curves of the core and side walls and allows the instantaneous recuvery of the rubber to its normal shape after encountering obstructions in the road. This latter feature is made possible by the short "nose," or distance between the outer and of this hallow more on the "noue," or distance between the otter end of this hollow space and the tread of the tire. If the road shock were to be transmitted from the tread to the small circular opening near the base of the tire, a perceptible lag would be cre-ated which would reader the action of and which would remore the action of the tire practically the same as that of a solid tire at high truck speed. The "aircore" tire is intended by its makers for front wheel service on all trucks except the heaviest, and for rear cept the nearlest, and for Pear whose nearles on those trucks which require realliency, high speed ability and econ-omy of operation. It is made in sizes ranging from 34 x 4 to 40 x 8 and 38 x 10. The prices of the various sizes are con-siderably less than those of the same capacities of truck pneumatic tires.

Our Readers' Point of View

The editors are not responsible for statements made in the correspondence column. Anenymeus com-correspondents will be withheld when so decired. e considered, but the names of

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RAY G HULSUN, D.O. Kirksville, Mo.

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Gyronecopic Motion

Gyronecopic Motion

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L. A. RHOMAN. New York.

Mathematics and the Spirits

Recently Patented Inventions

Brief Descriptions of Newly Invented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

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Fig 5: R W Higden s invention gives a better scaled joint for pipe sections than here-



Fig 6: A new way of keeping the water sep-arate from the cooling ics, patented by J Raggie and F Bongtorni



Fig 7 More certain and effective operation to claimed for T J Cabill a new flush valve



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the lime HARR CIRLER—E CAMMENS SIS No. 7th St. St. Joseph Mo. An object of the invention is to provide a covered wire past with an arrangement of covered wire projecting through the curier and having looped ends which permit the suds to be bont over the harr after the latter at wound on the main portion of the curier and to present permitting of a changing the wripe in the ball. Ill cards in the receptacie. The device is in that the two lattest a would not recovered to the control of the main particle of the surface and to prevent TARLE-SELIUM CONSTRUCTION—E H COOK 100 Main fit N startown, Wis An object of the invention is to provide a tomical construction in which the sidning provide the maximum amount of supporting surface to the plates consorting the insulator provide the maximum amount of supporting surface to the plates consorting the insulator of the sidning that the surface of the con-deries in which the end sidling members are adapted to be raised algorithm on the surface of the surface of the said of the table. CALME 516 Starto St. Sellium and the surface that the surface of the said of the said traded for suspension from supporting the masked of paper or easily tore marked at pur-mission of paper or easily tore marked in the surface of the said of the said which the surface of the said of the said which the surface of the said the said which the said of the said the said the said of paper or easily tore marked its purpose is to provide a simple and insequen-ter that the weight of the occurses will be metalted by a relatively large portice of in providery.

BUTFUNI.—B. L. KEUTPAIR, BOT SS, | articles. An object is to provide a case Bouchelds, Mr. The present object of that which embodies in one articles means for energy controlled on the provide and the provid

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COST.

PIVOT BUTTON —M. Werss, 148 Beach
74th St., Arverne, N Y The object of this
invention is to provide a simple and efficient
button of the pivot type designed to carry a
cloth cover and which may be resulf) attashed to or detached from any fabric.
Among the purposes which will set close
to the fabric to which it is attached.

BOLLER REMEMERS — E. KOWNE 6.0.

for crumental purposes which will set does the failer to which it is attached to the failer to failer

speen, as, for instance, a pocket or handbag EEDF ATOR INTERLICORIUM D. D. VICE—J. E. W FOGLA of Progal-Williams Safety Devices Co., Quintor, III. Among combination lists for director deeps and introducing safety device which is simple to receive the control of the control of the control of control and the section of control are which the steet the control of control are which the steet the control of control are the section of the control of the control of control are within the section of the control of the c

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manufacture.

DENTAL TOOL.—G G BELL, Ambland,
Ky The invention particularly relates to a
tool in which a plurality of teeth are provioled, adapted to move in various eferular
pairs when the tool is rotated, for the removal of the excess plaster from a plaster
of parts model so that it may properly fit within
a

moved as desired CASTER.—II R KWARCK, 144 N Lin coin Nt. Chicago III An object of the investion is to provide a caster that it applies and the like, and has necess for bolding at said the like, and has necess for bolding a ball member to that the latter has a rolling contact with the floor. A further objecting the contact with the floor a further objecting a ball member to inperfull excangement with a floor and for preventing friedon between the movable parts.

Heating and Lighting

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POWER-TRANSMISSION MEDIUM.

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that they are held against novement length-wise of their shafts.

RECORDING DESTROE FOR LIQUID CARPEN CARPE

this invention is to provide a power-driven was also approximately controlled in the controlled provided provided in the controlled provided provid











Fig. 12: A. Schoon's improved machinery trianning the fronts of shee-heats

(ONTERIOL HEAD—D Rammora, Bost maintaining the invalid or patient is assettled to well-felling apparatus, wherein values in false position. By the use of this derivative well-felling apparatus, wherein values in the patient is maintained in proper patients of soil results of the proper patients of the patients of

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head deposited.

SPLIT HIPB HEAD FOR CYLINDERS

FOR SPINNING FRAMES, SPOOLERS,

AND CYLINDERS OF LIKE NATURE.

—W Dissont and J H Jawres, address

—W Dissont and J H Jawres, address

et al. The contract of the contract of

Musical Devices

Musical Durkess
LEAP TURKER—I) Honora, 264 Ver
derbilt Ave., Brooklyn, N. Y. One of the
principal object of the invention is to proturning leaves or the tire the second
to the tire the second of the tire
to the tire will be relieved of the secondity
object is to provide turning mechanism in
the form of a fell which may be smally appeak bettom screating means for furning the
shoets.

cheets.

Prime Mercers and Their Accessessies
CARBURETON.—A. H. Wrann, 166
COLUMBA Are, Notero, Mea.
Columba Are, Notero, No

service. A further object is to provide and assessed sharp curves. PURIS STINNING PLANES, SPATIAL COLLEGE AND ALLEGATION AND CARRESTS.—A. W. Harmon and J. H. Javera, address of the part of the part

understand presidently in the empaneity of the postuments of the president of the postuments of the postument of the postuments of the pos

Study of Material and Methods Needed in Non-Metallic Gear Production

ACRESTANT frame and, drive of lattice or posiinsperies areas on consumparative with mentaling general contractions and the second of the contraction of the special provided proper precurations are taken in the grootsees of manufacture. Blanks for mentaling upon with more expressive than those for mentaling that the contraction is the member of rejections for finds by a reduction in the member of rejections for

and rebuilding dependence. However, the material can be used to best dynaming only if the material curves first acquireaus intimate knowledge fits properties and of the best methods of handling it. Where gaser drive is used for the front cod, the problem of allest taken will residely fine the assessed by the problem of the con-

Where gast drive to used for the front cod, the problem of aliae operation will probably first be statistical by the manufacturer from the standpoint of improving his metallic gars. In analysing his problem he will invariably find that the difficulties may first, the high cost obtaining extraces contracy in gast manufacture, and, second, the contract of the manufacturer is the standard of the manufacturer.

The exposes of parchasing metallic pares to extreme accuracy judicially leads to a spirity of one-metallic materials, with which quiestees can be secreted velocity going to the engrance in low othersnoot leads. Recombly there has been considerable discussion of the possibilities of grinning front and pares to obtain accuracy. Owing to the limitation of gasgranding metalless up to this time, this, of course, would involve a recorn to the layer type of gast, a rather drastic step. Developments there is the second of the course of the course of the course of the second of the course of the co

along this new vessels to or given inserved.

The Foreign Inspiration Co., manufactures of non-metallic guarlicating has made an instructing study of just what can be accomplished with non-metallic material. The concern has more than spon, on suggetiming guaran new in service, it maintains that the fundamental requirement notes of guarant metals in the nar couly must be able to write-task the study of the country of the country of the care of overload and short constant.

Moting power fields this requirement, but it is difficult to hasp than interlevely design features sight inconvention on Euley's oncore in their numberine. The metal is not quiete enough to companie for their annealment. The metal is not quiete and the "sing" of metal their power of the sing of the sing of the sing of the sing of their power of the sing of the sing of the sing of the sing their power of the sing of the year of the sing of the sin

It must be conscious an experimental work, but full down in narries, There has been spent deaf of development since these times, with the result that it is no possible to science products having above predicts that may not the result that it is no possible to science products having the required undifferently and endurance As the sentirel is non-venous and is adoptiate in strength, the entire matter centers about the linear/sign of flow to manufacture the passion that linear/sign of flow to manufacture who has used non-metallic material, for years given the following reals for the production of the recurs:

Age at a precedent year toward the control of the c

country ones of changing thoming passes on a smoot finished engines. As the spision of this mannicature seames to agree with that of most others with have offered their releases on this important subject, a further expectation of the points mode by this will be of innerest. It is necessary to we produce the points made by this will be of innerest. It is necessary to we produce the points made by this will be of innerest. It is necessary to be represented in the product of the points of t

In cutting men-metallic genre, the blanks must be backed up so as to avoid breaking out stack. As far as speeds and feeds are concerned, most of the non-metallic materials can be handled like breas, Some materials are cut day. Setting helps one of these.



Part of the Part of the Part of the Part of

Quiet gear-driven front end obtained Tests with a typical product indicate blanks are more expensive than metallic type. Fewer tear-downs and easter inspection offset extra cost. Analysis of manufacturing processes improves results





Fig. 2.— Four-year train for front end drive on Rec engine, employing Formesa years for the cranitality and after years, and metal years for the camehaft and generator drive years.

entirely estisfactory as far as wearing qualities and silence are concerned states that lapping compound of any kind should not be used in running in the case-tong near with a material gar. The sharawar in the lapping compound imbeds leadiff in that gear and very shortly cuts away the teethed of the non-necessitiling gear. This manufacturer further states that he suspect that this practice has contributed to any lack of success with

Tolorances for Fermica Goas

It is, however, a fact that Formice gare, as used in the foots they contain particular car in both four and excipitate types, he proved assumed to the foot of the provided assumed to the contained to the provided assumed to the contained to the

The shaft centers, however, must be ledd quite closs. One concern to the Formica genes to have about closg; in becklast, if the tooth for and helfs are held within narrow limits, the results have proved we asstaticatery. If no accurate, the genes were our trapidly, and near every case of undue deterioration has been chargeable to imprope tooth form or error in the angle of the teeth.

In manufacturing tuning genes from non-mealing substances, it seems to the contract of the details of the contract of the

necessary to check the finished predict very closely while setting up the tools, as the material has a slight tendency to spring away from the cutter in machining. The Marwell Motor Corp, has found that the seminist can be held as on metallic guars. When this is done a quiet free and is possible with negligible selection in assembly a consequence with its decimal expectation. One of the received with the decimals when highly referre than any other is

concerns on this this was of them smaller materials for from and driven, inwhich the large of mandatal pure or the same for excludation and of the same which the large contained gave about the same smaller, but manufacturers that the canadatal gave about the same smaller, and manufacturers the same smaller of the same smal

Uniformity in Manufacture Stresses



Fig. 1 — Two year train on the Marcell motorusing a Formion purson on the orankehaft against a metal camulaft year

everal reasons. It is quite apparent, for instance, that the strength actors with that type of insterial decrease very rapidly with increased hancere. Consequently, the smaller gaser are far stronger than the agree canshaft gazes would be. Furthermore, the cost of the gaze black near rapidly with increased dismerter and, taking account of these ranous factors, it will be seen that a more durable and lower priord rantalization results if the two mainting egazes are made of non-metalile.

natural, rather than the larger canniball goar.

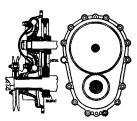
The development of Fornica material has programed over a number of years, and the method of manufacture is of interest. The bag problem to so sower not colly the ancessary physical propertups, but also a lagh great of the control of the source of the control of the source of the control of the control

grain. The cotton dock, in the form of a continuous web, is subjected on at The cotton dock, in the form of a continuous web, is subjected on at most the complete impregnation of every filter of cotton with the reads. After impregnation the restrict days in great through a season-leased rown, the speed of passage, circulations of als and suspensions being covered to the season of the contract of

natural is cured at a temperature of about 775 dag. C. The time of uring varies with the thickness of the abeets being manufactured. The final curing completes the rescribe in the phenolic rests and rescribed the product practically infusible and insoluble in water, oil or very of the ordinary olivents. The natural is removed from the pressurtion of about, and from these about the blanks are us, either by what serving the control of the control of the present and using or circular cutters. Then naturally a blank are us, either by and saving or circular cutters. Then naturally a blank are us, either by

mosture absorption, etc.

The final product has a tensile scrength of about 10,000 lbs. per sq. in., a modulus of elasticity of 320,000 lbs. per sq. in., a Brusell hardness of 34, a specific gravity of 1 38, and a coefficient of linear expansion of 0,0000 hardness Pales.



'ig 3 — Typical fabric year dries as used on the Oldsmobils

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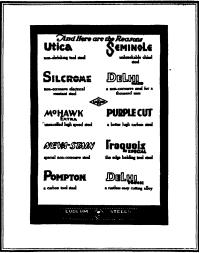


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that the available head of water is too low for precision. Since—A contributor to the American Manhiniza advocates the use of cilindrical sate. They may be not on and vasily made of evop ends of shaftings, and rods and bear. They may be sweed off, and rods and bear. They may be sweed off, or covered at the same time. When used on machinery they are now easily kept clean machinery they are now easily have been a larger facting that hexagen note. Combined larguists and Reaction Tar-torial than solidy resolute type turchine, ar-certing to Force in the formar, steam is through two rows of revolving blades. The steam from this point is expanded in a long four takes place in such row The imprise steam has been though the steam of the four takes place in such row The imprise steam has the badde and take up less from takes place in such row The imprise steam has the badde and take up less reaction type. A Méxic System Compromiss—The

reaction type.

A Metric System Compromise—The advocates of the motife system, having fields of are to introduce the system into the fields of are to introduce the system into their game in another direction and are try into their game in another direction and are try into the pound weight, in order to give it simple relations with the nortice system. This would have a weight of 500 grams, instead of 454 ft this could be ecomplished without tup-setting dwilliamton, the result would be of the different pound goes marching to the different pound goes to the pound of the pound goes to the po

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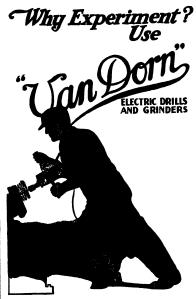
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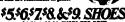
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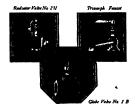
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ONE of our regular correspondents has been spending several weeks in Wash lagton going over reason of reports and statistics. He is now down South look ing into the his projects in the planning and in the building for that wast territory which is replicy developing along industrial lines. This correspondent is work ing on the subject of water power he is

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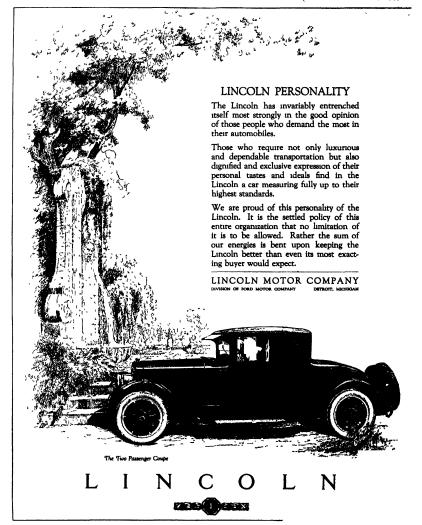
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NEW YORK, SEPTEMBER, 1923

HR United States is a wheat-produced goeing country, pare excellence: A Nation of Milk Producers and Users setting his full share. Our annual configuration of the datry producers—affix and cream, batter, been, and the other things that come out of the milk and cream, batter, been, and the other things that come out of the milk all. Octon has been king, and will be sunin, if he is out actually on the through at the noment, but see every step produced on all our farms is worth barely would double the national research of the step of the producers of the producer of the

aif as much as the output f all our cows. If we add ito a single item the potato, ats and tohecco crops, they ill total only a little bit sore in value than milk and slik products. We are the reatest live-stock nation in reates: live-stock nation in be world, yet if we were to ring into the market for laughter and sale every to set and in al. every lamb at the United States, we nould find that the pro-seds would not pay for the sity products of a year he dairy products are pro-ued without destroying the sity cover, who so right used without destroying the airy cows, who go right head next year as last, and the procedure suggested ould wipe out the meat erds. That is to say, the utput of the milk industry i equal to the entire capital lock in trade of the meat

stry ! industry exists in the Dated Riches number approximately \$30,000,000 bend. They are found of count of Dairy cattle in the United

chiamous from Inis gove into the manufacture of milk powder, malted milk, and other minor commodities, and allows also, for the

watage and losses Incident to sumministrating processes.
We have in operation—or wish the rout of a sumministrating signature of events in a sumministration of concerns sugged in the distributions of concerns sugged in the distributions appear of the darly flowings. The average sulfit production of 25,000,000 cores that the being milled in the United States today is 421 footned per year. As showing which have been produced by the product of the darly flowings and the succession of the success of

0.00

The figures bear out the carteenist's idea of what the cow means to the United States



The distribution of our annual milk crop among its various uses, both in passed, is indicated in the above graphic statemen stare figures and in

000,000 people will indicate that we produce 100 gallons of mills for wach sean, wegata and child. Of this, we see that the produce of the pr

cows in this State New York and Minnesota came next, with 1,678,000 and 1,641,000, respectively Illinois, Iows, Pennsylvania, Ohio and Texas also have each more than a million cows in milk production.

Speaking of the condensed milk end of our dairy indus-iry, it is of interest to learn that the annual output of cans, placed end to end, would encircle the globe not quite five times. To fill these cans requires the milk of over 900,000 cows. A years production of canned milk, packed in cases, would dupli-cate the pyramid of Cheops, which measures 495 feet from the base to the peak A train 490 miles long would be needed to hauf at one time a years output of condensed milk One year's out put of condensed milk repreput of contenned utili repre-sented 2,031,000 000 pounds in the cun, and 4,504 000,000 pounds in the raw utilk state. Condensed milk con tains 30 per cent milk solids, 30 per cent water, and 40 per cent cane sugar Evaporated milk is un sweetened milk, the reduc-

tion in bulk being obtained by the elimination of much of the original water content It is said that through the condensing and evaporating of milk we are saving in freight handling some 1,200,000 tons annually Not only in reduced freight costs only in reduced freight cont-but in other ways the con-densing and evaporating of milk has proved a great boon in many parts of our country, particularly the South, milk is not obtainable in the fresh state and re-liance must, in part, be placed on canned milk, which thus becomes an indispenseble feature of the diet rather

ble feature of the dier rather. The symbolic Uncle lates an emergency measure serving in many capacities—cancilan of the freeze modifier, diplomate, agriculturaling postal official, naval officer, and so on. This distinguished perwone, it and officer, and so on. This distinguished perwone, it and officer, and so on. This distinguished perwone, it and officer is the second of th



The Inventor and the Gay Gambler

Ingenuity Ranging from Marked Cards to Crooked Roulette Wheels for Separating the Fool and His Money By Edward H. Smuth





N THE misty prehistory of India there lived one Raja Yudhishthira, a first-close gambling mun. He is the Odysseus of the Mahabbarata, that great epic whose prin-cipal parts probably date half a thousand years before Jesus. His was the Pandava

priers before Josus. His was the Pandaws. I clus from Wheeler's translation of the cousin, Kaurawas. I clus from Wheeler's translation of the begins and the January of the Cousin, Judicial Course, Judicial Cour with dice that were londed, insomich that whenever be played he always won the gain 80 buryodhana plotted with his uncle that Yudhishihira should be in-vited to a match at gambling, and that Sakuni should challenge him to a game and with all his wealth and

dudhishthira lost all his wealth and lands and his kingdom, right enough Worss yet, he staked the macred polyandrous wife, Draupadi, against Sakuni's queer dice and lost her into the bargain. After many wanderadventures he, however, regained all reached the sunlit brights-so that a gambler evidently

reached the small heights—so that a gammer evidently may enter the kingdom of heaven. Yet this is hardly the point. What is worth noting is the fact that in the day of Cyrus, Buddin, Nebuchad nezar, Crusus, the first Mikado, Plaistrutus, the last furuin and the first Roman consuls, and other such ments for the gaming table yes, probably long before! Thus the gambler inventor, though he rank not with the man who chipped the first flint hand ax or fash-toned the stone skull crusher is, newrtheless, one of the earliest improvisers of the instruments of civiliza

The disastrons dice of hudbishthira were called cospus, and the modern gamester might have some difficulty deciding that they had not been made last week in Chicago. A number of these ancient and faithless cubes were thrown from the veritable box still in with the same perfidious raiss and any anthropologist will tell you that the darky's

deviction to the galloping tworten may be partly the scurvy inculcation of the scurvy inculcation of the white man, but is at bottom the deep tradition of a sim ilar instrument of treacher; and glory, much used in savage Africa So, the first emotion that

sweeps us when we think of the connection between of the connection between invention and gambling is a sunking of the heart at man a sanctent and unre-generate reguer. Men were loading dice before they had drenned of the globular earth, they had swords of steel while they were still ploughing with forked atteks. And globule so, perhause

And rightly so, perhaps.

The uninitiate modern gen
tleman, when he travels in tleman, when he travels in a Pullman compartment and plays a disastrous game of poker with affable strangers is appalled when he discovis appalled when he discovers later that a pack of marked cards has been his undoing. Yet listen to George Devoi, the famous old Mississippi River gam blee, writing of an event be-

"While waiting at Donels ville for a boat to take me to New Orleans, I fell in with a fellow who proposed a game of cards to pass the time until the boat arrived. We went into a select and set down to play a game of poker He brought out an old deck of marked cards, which I recognized the moment I saw them We began which I recognized the moment I saw them We begins to play I knew the fellow took me for a sucker, so I let him play me with 'his cards' until I got a chance to down him, which I did, for all he had"

So, whether one look down the distant vistus of time

So, whether one look down the distant vistus of time or merely glance at the immediate past of our own country, the result is the same We find the "fixed" gambling device in use everywhere The inventor of such infernal stuff has been at work since the begin such infermal start has been at work since into beginning. But more laughter or indignation kindles (according to temper) when we find that today the invention or deviding of crooked implements of the game is an organized business: that here factories exist which turn out marked cards, loaded dice, fixed roulette wheels and many other such pretty instruments by the thousands. Once this is realized, we are not further listurbed to find that every experienced gamble his own cards, loads his own dice and contrives other "controls" of his weapons.

The interest, then, lies rather in what these inventors

and improvers have achieved. It is a well kn ciple of gaming that the nature of the trick must be varied from time to time as the sucker becomes au-picious of or familiar with one fraud after the other this fact that keeps the inventor and adapte ever at work. Since dice seem to be the most ancient and simple implements of play and cheating, we may as will see what has been done in this field.

as well see what has been done in this field.

All die are fixed in one of two ways—diec used for
the everlasting game of craps, I mean. Some are so
corrupted that the advantage will lie with the player.

These are commonly called passers or hitters. The
others are arranged for the benefit of the banker or
finder (wheever best that the player will not make his rader (whoever ones that the player will not make mis-point) These are known to the gentry as misecuta, faders or bunking dice. In almost every instance the same method used for making passers can be employed for producing misecuts. It is merely, a matter of cau-ling opposite combinations of numbers to turn up. For instance, if the player can be sure that the numbers 4 6, 8 and 10 will turn up almost invariably, he has a considerable percentage, since the fatal craps numbers 2, 3, 7, 11 and 12 will turn un less frequents. course, the player who uses such a set of "bones" gives up the advantage of occasional showings of the winning 7 and 11 on the first throw

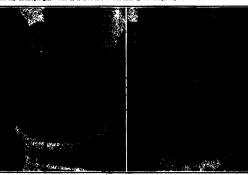
Tand I to the first throw
We need not go into the older methods of producing
such results. Indeed, it is not necessary to give more
ann passing meeting to the fact that transparent dies
are now louded with invisible bits of platinum behind
the agoria or that dies are now made which can be
spired or that dies are now made which can be
spired to that dies are now made which can be
spired to the dies are now to be the spired
spired the table sharply in various manners, explained
in the directions which the makers of those neightous
implements supply with such set sold. Mine-shaped, missported, adherive or suction die are all fairly well
known and ingenium setough. But there are recent dewithin the last three verse more of the introducions.

Within the last three years one of the professional inventors of crooked dice has brought out what is called

investors of crooked dice has brought our what is called the cupted dic I quote from his own description. "In making these dice a cup of race of specially prepared material is permanently attached to certain sides in his properties of the composition of the composition of the composition of the cupted and the cup is such that a die no prepared will above a triang percentage when used on a billiard table or other hard pathatane of similar terture. These dire can be used where shared (missianed) or loaded dice would be derected immediately finding or precentage, which has derected immediately finding or precentage, which has

where shaped (indeshipsed) or loaded dice would be observed immediately finder to percentage dice long since passed out of the field of the inserty played; and come under the purview of cleanity and elserticity. Various kinds of celliuloid dice are now made whose weight on certain favow can be definitely changed by of one of the high manufacturing firms. "Our special magic liquid, when applied to transparent dice necording to instructions, will afford the operator a handy and self-dict nethod of making per covar formula and penetrates the favor of the dice which it is applied, causing a change in the chemical composition of the celluloid. This results in bringing up the desired faces and gives the operator a good percentage. The work will lake indefinitely." In orbiting the control of the celluloid. This results in bringing to the object faces and give the operator a good percentage. The work will lake indefinitely." In orbiting the office of each which extend your change the nature of the celluloid to which it is applied, making it a drop of seld, which actually done change the nature of the celluloid to which it is applied, making it.

when it is applied, making it weigh less. Thus, if I want the number 6 to turn and the number 6 to turn plane of the die with the acid, and lo, the job is done But the most intriguing of all these pleasant inventions for the supply division of the for the swift division of the for the swift division of the fool and his money is the magnetic money drawer or shorecase hu mil do r Both work on the same principle, so it will be unificant to de-scribe the hundion, which seems most mysterious to the layman. This device is must used in cigar stores where much shaking for cigars or money goes on Its siren charm is based on a com m on misconcestion. Tis aform charm is based on a com mo nuisconception. Everyone had been told that stains in a son-conductor. So the stains in a son-conductor, and the stains in a son-conductor, and the stains in a son-conductor, and the stain is son-conductor, and the stain is son-conductor, and the stain is sold to some stain in a son-conductor, and the stain is stain in a son-conductor in a son-conductor



Covering the roulette wheel by no means protects the player



as dealing seconds. The dealer card slightly, to get at the one dealer is seen palling out the "second." rapidity and is generally rapidity and is generally end deal" The dealer Some tricks of the crooked dealer which take card playing out of the games-of-chance category

layer of fancy-sized cigars just under the box lid, in case any curious customer or dice player might ask to be shown. This magnet derives its power either to be shown. This magnet derives its power either from a series of dry cells or from a connection with the lighting circuit, the latter being the final rufinement the magnet is, of course, so raised that its directly under the glass top and magnetises a field perhaps 0.8 or 8 x 8 inches in dimensions. The rest constants of a foot lever switch and a set of

The rest consists of a foot lever switch and a set of electro-imagnic diec. The keeper of the cligar store stands in such position that he always dumps his diec on the magnetic field and an electronic field and the field in the field in the field in the field in the field is no longer magnetised. The percentage in favor of the man at the switch is very great. Nobody but a professional zumber is likely to suspect the device and such owners and such owners are the switch in a support the switch is a support the switch is a support the switch in a support the switch is a support the switch in the switch in a support the switch is a support the switch in the switch in the switch in the switch is a support to the switch in the switch is switch in the switch is switch in the switch

of this sort.

Cheating at cards is a subject for long and scholarly investigation. Probably their marking originated with the many centuries before they reached Europe. Speaking broadly, there are two meth ods of crooking cards— marking their backs so that the keen-eyed gambler knows trimming the edges in vari-Iffining the edges in various ways to ansatz in crooke the
dealing Marked cards are
called readers, those
trimmed at the edges come
under the general classification of attippers, though some are not trimmed for

tion of arrippers, through some are not rrimmer the stripping but for high and low cutting These terms will bardly need explaintion among card players. Marked cards can be and are being made in scores of ways. There are, first of all, the ready-made read

of ways. There are, first of all, the ready-made read are which can be bought from the same maintreturers who turn out the crooked dive devices. They are made invided markings, such as a slight dimming or dark-ening of a line or figure at certain piaces, to indicast, ones, kings, queens, jacks and teas, the important cards for poker. But the cleverest gamblers usually show these patient readers for the reviews that the next man may be as familiar with them as the gamester binuself Accordingly, the gentry make their own readers in many ingenious ways. A pointed piece of spermacetti,
wax or resinous pine, drawn across the back of a card

will leave a glossy trail which can only be seen when facing a strong light. The gambler sees to it that he is placed to see Couting the edge of a fingar or thumb nail with India ink embles the gamester to mark important cards at the edges while is is playing. Sand, important cards at the edges while it is playing. Sand, glass, emery, restin and actids are used to remove the glossy finish from certain portions of a card's back, and the sensitized fingers of the gambler then reveal what he is giving to this man and that while he deals what he is giving to this man and that while he deals when he comes to a destrable card he holds it on top and deals the next curd underneuth he a very simple selight-of hand trick. His purtner or he himself gets the good card and the next good one. In this manner he fills up hands for himself or his confederate

Other ingenious ways of marking are by a fine prick ing of cards near the edge by means of a finer ring on which is conceated this fine point or "peg" daubing

liself, enable him to see the faces of the cards as he situs them off, one by one, in desting fisch which are mostly to the early of the control of the control of the mostly to the early holdest machines, of which there is a staggering variety. Everyone reasonables the gambles who slipped an ear hij his sleeve. But supposing you which takes the access his sleeve, into his vert pocket or into the vector relief tract with magic artification and attence. Suppose such a muchine be capable of passing down into the vector-like than of the gambles a "void" eck exactly like the one with which you b playing, at the same time taking the true deck up the other sleeve out of the other hand of the evil magician Must I explain that a cold deck is one that has been stacked so that the cards will full in a fixed order giving the sucker a big hand but the gambler

still better one? Such mechanisms are known by various names which usually indicate their manner of operation There are arm pressure holdouts. are arm pressure hotcours, which operate by pressing the arm against a rubber bag concessed in the sleeve. Pressing the bag sends the hand of the holdout machine down the sleeve to grip or give up the desired card This hand is always an ordiary steel clip, su harm areas cup, such as may be commonly seen in offices where large stacks of papers are to be held together. There is also the knee-spread heldon.

There is also the knee-spread holdout. This is worked by means of cords concealed under the clothing and leading through small wests in the trusser legs at the knees, where they connect. By spreading the knees a little the mechanism in the slewtes pushes down to receive or release the capacitation through the contract of the cold deck. Again we have the chied cognision or receive or release the careful services and the contract of the cold deck. Again we have the chied cognision or

the coin new Again we have the chest expansion or breast holdon; unachine, which is motivated by infasting and deflating the lungs. These machines are always operated by a gambler who wears his cont, which may be marked for its long and loose eleeves. Accordingly, many partly informed men refuse to play in a game unless all remove their costs. unless all remove their coats.

But here agoin a little wisdom is a dangerous thing.
The inventors who serve the gambler have in recent
years devised a holdout machine which required no coat
or long sie was Here is the official description by its

inventor and maker (Continued on page 215)



Left: Desling from the bottom. The dealer down not hold the deet in this position in practice, but keeps the faces that the Blactristics he is beiding the deet up to show the number in which a ten of shahe is get from the lottom against extreme spidity. Black! Deslines afforcer. The last area area for some end and the low area for a reason to the dealer can arripe out all the desirable entile by pulling the deet sour with the facers aring the edges, as also Dealing from the bottom and dealing strippers

the cards along the edges with very slight finger prints of blue or red, according to the color of the deck in use, the color being got either from soft red and blue pencils or from tin, plilboxes of color in the opposite vest pockets, touching spots on the back of cards with volatile oils which durken the backs at the given points long enough to make them rendable for the period of long enough to make them readable for the period of the game but disappear later through evaporation, touching the edges of cards at fixed points with a strong solution of gam Arabic, and many other methods. But playing with marked cards is only the beginning of the requeer which has been applied to this antique pastime. The investions used are almost an numerous

pastime. The inventions used are amoust as numerous in the fools who play for stakes.

Little intrors or "shiners" cumingly affixed to a pipe which the gambler lays down on the table as he deals, or attached to a box of matches or to the table.



United States Forest Service Map at Overland Park,

HOUSANDS of families will "vacate" this summer—and in future summers—by fol lowing blazed highways in motor cars buiging with camp equipment For each portable canvas home there will be wait-

portable canvas home there will be waiting, in a choice of cities, free leasohible
of and for a "one-night stand," or even for a restful
visit of several weeks. From the Great Lakes to the
nulestic peaks of the western Continental Divide
unnichal homitalities of a surprising number are prenumichal homitalities of a surprising number are pre-

pured Toward sumet the tourist can begin to look for 'latch-string hanging out -a placard posted by the path, inviting him and his to use the town's free

Only a decade ago motor cars were of much less gen eral ownership - Few users had driven across as many as three states in continuous journey Highways then offered much less comfort to "mo-tourists" bumping over lowing in mud or straying from the intended way In the full of 1913 the Lincoln Highway Association was organised. In several suc-

ceeding sensons it was Fireplace in a mapped, marked, and mo-tored over Crossing the continent in a "gasoline caronce a great adventure, became a safe and comfortable pleasure trip.

The public must have been ripe for this, for the idea spread rapidly, and other transcontinental highways were soon named, financed, improved, and blazed by irrightly painted poles. From east coast to western water a choice of many paths may now be had. Numer our also are the ribbons of road intersecting our coun-try quite from north to south connecting Canada with try quite from north to south connecting vanion with the Gulf via the Mississipply valley states. To this legion of possible paths may be added the routes of trans-state extent, nurked by the cooperative efforts of groups of local highway organizations, or, as in Iowa and Wisconsin, by the authority of state highway officials. What are bettered reads and marked ones

Along the rendy rouds rolled first the motor cars of the well to-do, with paid chauffeurs and no dunnage except suitcases or expensive runningboard trunks filled with formal clothes. For the three "b's"—bath, nited with formal controls, for the times are—same, board, and bed—hotels were patrolised. It was early discovered that in some cities arriving guests would find the excellent hotel accommodations all bespoken. If nighttime chanced to bring them to some small town they would find only short-order restaurants, with food worse than indifferently cooked, and lodging hous far from meeting the familiar confort standards. St further west, in the spursely settled portions of the further west, in the spursely settled portlons of the high plains and mountains, there were apt to come hungry times and sleep), hours when no towns of any kind were discoverable. The writer once rode 125 miles in eastern Woming, on the Chicago, Black Hills and

Camps of the Central Circle Recognition Given the Automobile Tourist by Mid-Western Municipalities

By Avu Gordon Vestul

Yellowstone Highway and found but one tiny village in all that stretch, while ranch houses might be fifteen to twenty miles agart. The remedy was to carry a mini-mum of food, camp equipment, and water for emer-

gency use. Just such a taste of sceing a wide country by riding over a certain and conflortable course, lunching in a grove, camping under the stars, and the idea of plan-ning deliberately for camp life all the way grew like a snowball 1001de across the laws in melling weather Demand and supply not Pur handle camp equipment was soon improved to next the limitations of motor was soon improved to meet the limitations of motor portability and to fill all the varied needs of a com-fortable "home away from home". A complete outfit could be purchased in one unit, as in the cump trailer, or an outfit could be assumbled from a splendid assortment of separate units, from bed to stove, from bu ator The camp phase of motor touring had to retrigerator the camp passe or motor touring has risen from an emergen; necessity to joyful acceptance as a mode of life for the entire trip. "Motor-gypsylag" became a recognised part of the "back-to-Nature" move-ment. And from the cost and kind of many motor cars now carrying full cump equipment it is apparent that many relatively rich rouners have deserted the hotels. many resultively rich reassers have deserted the index. Beside them come motorisis from the great middle class and the great middle class and the great middle class. Even more in evidence are the numerous "fluviers," with five to seven persons, a dog, and a silhocetic like a moving van The multelpal camp was the next togical step. Not

the host camps they had visited in the mountains. The host five years a rapidly increasing namber of host towns have been authorizing sucher from the highways and byways by posting invitations at their city limits, or even many miles beyond on the main roots. The usual evolution begins with the tentative opening

The usual controls begind on fish sain node.

The usual controls begind with the tentative with the control of an existing part. If no shade exists, trees are planted and watered. If the site chosen is been due to community conveniences, or if the little town lacks there, wells are such and maintain provided. Within here, wells are such and maintain provided. Within are supplemented, in some cases, by near prunted folders are supplemented, in some cases, by near prunted folders are supplemented, in some cases, by near prunted folders conforts it offers, what points of interest may be conforts it offers, what points of interest may be conforted to first, what points of interest may be conforted to first, what points of interest may be conforted to first, what points of interest may be conforted to first, what points of interest may be conforted to first, what points of interest may be conforted to first, what points of interest may be conforted to first, which points of the supplementary in the conforted for the conforted to the conforted for washing variety, sometimes passed in the conforted for washing variety, sometimes and the conforted for the conforted for washing to the conforted for the conforted for washing to the conforted for the conforted fo tubs, occasionally even a washing machine and elec-tric flatters, portable or permanent tables and benches. Sometimes a general store is set up near by or the local establishments extend service to the grounds. To induce transfeats to stay over, recreation is be-

stay over, recreation is be-ing increasingly developed. The things established for local residents are shared and often added to Playand often added to Play-ground apparatus, boating, bathing, swissming, or fash-ing, golf, tennis, or base-ball, in the larger cities, visiting the nueum, suo, or mands outbook, danger wite

music centers, dancing, vis-iting nearby points of his-toric or scenic interest. The furces most active in establishing these camps are local divisions of the big are north divisions of the big highway associations. Cham bers of Commerce, garage men and dealers in automo-biles and accessories, civic

clubs, park boards, wom
mobile tourists

clubs, park boards, wom
m's succieties, boy acouts,
campfore girls. The point of
view may often be "calightand literally expended.
Where odly eating comforts are offered upon
grounds already provided with park caretakers the
additional so it is more than over its surretimes to me. by



hospitality, as were a few other towns in the scenic parts of other states popular for vacations.

But the central states? Tourists had been hurrying through them, pitching tents by the roadsides. There was no invitation to "stop and shop." By 1917 a few towns shop." By 1917 a few towns began to permit camping in some public vacant place, but seldom was any provision made for comfort or to en-courage lingering. But the courage ingering. But the close of the war saw a great boom in the establishment of nunicipal campates by the cities of the central plains. Many of the residents of these states had themselves tasted

askance at the visitors not putting up in hotels. It was some apparent that these were decent, law-abiding

folk—prosperous farmers, substantial bankers, oil mag-nates from the southwest, reputable physicians from Iowa, school teachers from Illinois, Missouri merchants lowa, school teachers from Illinois, Missouri merchants with a good rating—all with coin of the realm in the pockets of their khaki. Far-sighted boosters any the drift—and catabilished free municipal camp-sites. By 1918 a number of Colorado cities were offering such

accurrence ceet is not great. When utilities are added to improve the grounds the cost is sometimes borne by city tax funds apportioned for park development. More often, however, the additions that are made and extra labor required are paid for by organisate private interests, such as the Commercial Club or Automobile Club.

Comfort station in the public complex ground at Canon City. Col.





Electric light, running water, firsplaces, shower baths and free wood are among the things provided at the municipal camping ground in Pueble, Cel

The merchants derive benefits which compensate them A camp does often help to "put a town on the man," and occasionally visitors decide to become residents, while the guests at a camp often spend conside

sums in the town Space does not permit consideration of the co Space does not permit commerciation of the charge of the entire country, and as those east of the Alleghenies are few, while those west of the Rockies are better known, we have limited ourselves to the central states abown, we have limited ourselves to the central states, through schick motoritats used to pass on their way to mountain or secanors, but is a high the may now find lingering a pleasure. With it litle, hamen, approxi-mately the geographical center of the country as a hulwith a radius of about 500 miles, we can draw a central circle which includes all of portions of twenty states of the Mississippi Valley, reaching up the high plains and touching the Rocky Mountain region The following

iouching the Rocky Mounthin region. The following list of campin is fourted in this crite. Under each state loading the parts numbered (1) were obtained through questionations sent to the Commercial China of two Spred by the writer, while the parts numbered (2) were obtained from newrapper clippings, from people who had visited the places named, or from the literature of highway associations. The list as a whole cannot preced to be excluded with the places named, or from the literature of highway associations. The list as a whole cannot preceded to be exhaustive as the number of such camp-sites is con stantly increasing

the number of such competes is com-rantly increasing Eux Cuine, Medicon (2) Abbettord, Alun Center Ambred Tunction, Augusta, Indola Barnhoo Berlin, Birchwood, Black River Falls Cupring, Oblumbus, Durand I all Hiver, Fennimenes, Frederic, Huden, Ilmuler Fennimenes, Frederic, Huden, Ilmuler Fennimenes, Frederic, Huden, Ilmuler Grand Competent, Competent of the Masonanie, Memouline, Merrimon, Millia Masonanie, Memouline, Merrimon, Millia dere Nelsones, Pepila, Portage Port Ed wards, Rice Lake Richland Center Sparta, Spring Genes, Spring Valley Waterloo, Wilson, Wonewor Wilson, Wonework (Millian) (1998) (1998) Waterloo, Wilson, Wonework (1998) Waterlook (1998)

camps reported within limits set Missicasia (1) Austla, Bowius, Breck etridge, Fergus Falls, Long Prairie Mankato, Minnoapolis, Montevideo, Bed Wing, Rochester, St. Paul Wells

Wing, Rochester, St. Paul Wells, Tolors 1) Charles City Clarkaville Chinon, Council Hinfu, Des Mothes, Iown Cuty, Kochut, Lain Milla, Lace Martia-Rock, Marton, Mason City, Mr. Possach Rock, Marton, Mason City, Mr. Possach City, Alexandroth, David City, Hawardqu, La Peris City, Little Sioux, Missouri Valley, Mondannia, Northwoot, Oone, Saltx, Répeas, Westfield, Whéting

Méssouri, Strachfield, Hanalbel Emssaches

gracown, arcoknede, Henantes Kansas Kr., St. Joseph, St. Louis, (2) Bloomfeld, Brecken-des, Cameron, Carthege, Deflote, Farmington, LeClede, detth, Ouborn, Prylay Bluff, Silesten Arbitects; (1) Marion.

spicion: (1) Shreveport, spicion: (1) Shreveport, sen Palesti: No camps reported within circle

n. köfi Belisis; (1) Dendwood, Mitchell, Rapid City, rfish, Sturgis, (2) Aberdeen, Alexandria, Bridge-r, Canton, Chamberlin, Onjtchwood, Custer Emery,

Fairview, Hot Springs, Hudson, Huron hadoka Ken nebec, Kimball, Lead Mt Verzon Murdo New Under wood Onkoma Piedmont Flankhith: Presho Puk-wana Quinn Rellance Slouz Falls Vivian Wall Wasta White Lake Whitewood

n Czad Fremont Nebraska (1) Chappell Columba Glibon, Gothenburg Grand Island Kearney Levington Lincoln North Platte Onuha, Sidney (2) Central

City Elm Creek, Valley
Adnasa (1) Abilem Baxter Spring Coffeeville Aossez (1) Ablient Baxter Springs Coffeeville Ellaworth Garden City Hlawatha Highland Larrad McPhersee, Manhattan Marion Pittsburg Sallias Wamego Wichita Winfield (2) Delge City Great Hend Hutchinson Jamethon City Lvas Switon Oklahoma (1) Guthrie Miami Oklahoma (11) (2)

Clinton, Granite Shawnee Texas (1) Denison, Pt Worth (...) Wichita Palls Wyoming (1) Chevenne (2) Poughis Larunie Lusk Bundance Torrington Wheatland

Colorado (1) Boulder, Canon City Colorado Springs

Schoolroom Ventilation

TilAT a well designed but simple arrangement of window ventilation is the most promising method for classroom ventilation is the striking conclusion reached by the New York State Commission on Ven-tilation

tilation. The commission made a careful experimental study of the effects of atmospheric conditions on health and of the efficient careful on an apecular constructed chamber in the tablege of the 'tity of 'New York, and conducted a practical varray of the vestitating systems in use in the schools of hydrafield Massa, New York City, Minnespolis and other cities.

The commission found that while window ventilated rooms have less complete air change than fan ventilated rooms this reduced flushing was not objectionable. It rooms time required musting was not concernenate it was found sufficient to supervess the secumulation of odors and it permitted the maintenance of a cooler alr conflitte which the physiological and psychological experiments of the countied and shown was more favorable for comfort bealth and efficient Intribermore window variitation.

did not tend to produce that uniformity of air currents and temperature charactoristic of fun contiluted rooms which was found to exert a definitely harmful effect on health by promoting susceptibility to disease and affections of the air passages. in schoolroom ventilation the commis-sion emphasizes the need of careful temperature control the temperature not to exceed 70 degrees the use of window reflectors to prevent drafts and adequate gravity exhaust ducts not less than eight square feet in diameter. The use of suc tion fans in the exhaust ducts was four to militate against the success of the average charroom the most agreeable temperature was 67 degree a

While well devised and controlled sysclosed were found capable of producing excellent results certain characteristic inherent in this method made them defi-nitely inferior to a good system of win dow centilation. Where used however, the commission found it necessary not only to have adequate provision of fan motor, duct and resister equipment but also to control mechanically and individu ally the temperature and volume of air supply in each room — 4bstract from School and boxiety for January 27 10.28.

Fighting the Corn Borer
MORI than 1000000 individuals of an important parasite of the Furupean own borer Habrobracon brevicorats Wesmatch have been successfully rearred and

liberated in the densely infested area in New England. It was believed by entomologists of the United States Department of Agriculture that it might be worth while to attempt to introduce it into the badly infested areas of southern Ontario I ollowing a suggestion to this effect made to the Dominion ento-mologist, authorization was recently given by the Canamedigast, authorization was recently given by the adding government for an assistant for this purpose. This entomologist recently visited the laboratory at Arling ton Mass to receive instruction in the technique necessary for handling the particle.



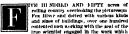
Driving through the camping area at Overland Park, Denver

Denver, Florence, Ft Collina, Greeles Longmont Platterilla, Possbio, Rocky Ford, (2) Rerthoud Blance, Besera Yukay, Sulmington, Crippie Creek, Del Notton, Denver Bernard, Colling Britago, Wallington, Westelline, Trial dad, Victor, Wallington, Westelline, Westelline, Trial Thus the submobible tourist is neuroral of camping spaces isong his route through the control states, and, uttituately, in all states

"A Small Private Laboratory"

Some General Impressions Gathered During a Visit to the Riverbank Laboratories

By Austin & Lescarboura, Mem. A.I E.E.



closest to his heart a vast array of all number of lies closest to his heart a vast array or all number of scientific equipment in the hands of skilled technicians, a quiet, cheerful, healthful atmosphere conductive to creative activities, and last, but by no means least, time, time, and still more time that is so necessary in evolving answers to scientific problems which have long buffled on altogether too busy world—that in brief, sums up the broad impression of how a remarkable man has realized a remarkable idea

The locale of this story is that stretch of country between Batavia and Geneva in the State of Illinois, some forty miles out of Chicago The remarkable man is Colonel George Fabvan. His remarkable idea in fully materialized form, is known as the Riverbank eratories. And the reason why you have not heard antomoratories. And the reason way you have not means of these things until now in due to the extreme modesty of Colonel Fabran who has always made it a point to do things rather than to talk about them

Where Utility and Architecture Meet On arriving at the Riverbank Laboratories, one is

suddenly confronted by a group of odd buildings. In deed, the immediate impression is that one is about to engage in a brand new kind of experience, and subse-quent developments confirm that first impression. The buildings have apparently been constructed with but rought in mind, namely maximum utility Con-

ventional architecture has been cust uside Particularly as regards one of the build ings, the bisarre feature con sists of a step-like effect due to each successive floor is ing foor below it. In this number second floor is surrounded lo a concrete terrace which is, in reality, the roof of a goodly portion of the ground floor while the third floor is surrounded by a similar tersecond floor, and so on The towering structures erected by

wooden blocks.
The Colonel knew what he was about when he planned buildings of this terraced type In the first place, the various floors have convenient terraces which may be

reached by doors. Then, when it is in order to provide additional floor space on any floor it is only necessary to build the necessary outside walls, as well as a con-crete siab for the additional roofing and the job is Thus a laboratory building of this type keeps up with developments in much the same manner as the sectional bookense idea

Other Riverbank buildings are constructed with wings and towers and other irregularities, niways with paramount purpose of providing the maximum utility. The author does not happen to have a complete list of buildings, but it is certain that there are at least a dozen unfor laboratory buildings, together with bung lows and barns and surages and tool houses spread out over the vast tract of land

So much for the buildings externally speaking. Upon entering the first of these buildings, we are amased at the vast array of equipment. Here is a mechanical laboratory equipped with lathes, drill presses, automatic saws, strength-testing machiners, and so on conducted to a corner of a large room, where a curtonsly mounted electric motor, driving a countershaft by means by delicate testing devices, discloses a mechanical problem on the scientific operating table

lient on the actestime operating table. The problem proves to be a test on the relative wind friction resistance of open wooden pulleys with their spokes or webs exposed and the same pulleys with disks that cover the spokes or webs and thus reduce

the wind friction. Off hand, even the most thoughtful among us would probably dismiss this wind friction possibility as being quite insignificant and not worth the bother of experimentation. But not so with Colonel Fabyan who, although not a technician blusself, has the happy faculty-of looking for probable scientific developments in add corners where none are believed

So the Colonel turned his staff on the puller probto ne colouge turned in each constitution and already the experimentation has proved most premising. The author was shown an alternating current motor suspended on ball hearings, alternating current motor suspended on hall bearings, the axis of suspension being coincidental with the axis of the motor, while the motor itself was counterbalanced so as to remain in any position to which it was rotated on its bearings. A spring dynamometer was connected with the motor shaft and the speed of the driven pulley was obtained by means of a speed indi-cator. The amount of mechanical energy consumed cater 'the amount or mecanical energy consumer, was estimated with great care. The wooden pulley was then closed at its open ends so as to cover the spokes or web, and the tests were repeated Measure-ments indicated that considerably less power was required to drive a pulley, and the operation was appro-

Clabb less noisy.

This demonstration has established the surprising fact that considerable power is now going to waste in many of our large shops where power shafting and

transmission pulleys are still used instead of individual motor drive One pulley alone may show but

OME time ago we received a letter from one

SOME time ago we received a latter from one Corpte Fesham of Cheage, which road moratory which were a small grinder late of moratory which is meantained by me for the purpose of investigating that which interests me It is not a commercial laboratory and I must interest the commercial laboratory and I must interest the sould undoubtedly be of interest to the SCIENTIFIC AMERICAN and the public versued the immall protect laboratory, otherwise known as the Green Laboratories. It provide a surgrue party. In the accompany article, our Managing Estate talls which see the critical terms of the commercial control of the control FDITOR

> a small loss, but when this loss is multiplied many times in a large plant, it becomes appreciable especially dur-

Delving Into the Mysteries of Sound

Other experiments are being conducted in the me-chanical laboratory, for it is obvious that mechanics figure largely in any problem that is being investigated, not to forget the machine shop work connected with general experimentation

general experimentation

Leaving the mechanical laboratory, we pass on to
the sound testing building, which is known as the Wallace Clement Sabine Laboratory of Acoustics. It appears that this beautiful laboratory was built for the
researches of the late Professor Wallace C Sabine of
Harrard University by Colonel Fabyun, his rriend This laboratory is a three-story structure of brick and concrete, containing a building within a building, as depicted by our staff artist in the drawing on the facing

It was Professor Sabine's wish to produ in which all sound from one portion can be complete excluded from another portion, excepting as it pass through a wall whose transmission is being studied. It was no simple matter to obtain this special condition. for sound is an elusive thing which escapes from one confined place to another by various subtle means. But by the application of great skill and inguious care the problem was finally solved to the complete satisfac-tion of everyone by Mr B E. Eisenhour of the River-

bank Laboratories staff, backed up by the keen personal interest of Colonel Palayan.

The accounts isboratory consists of two entirely separate structures under a single roof. It will be noted by referring to the accompaning drawing that the inner room or sound chamber is completely insulated from the outer no far as small transmission is conform the outer no far as small transmission is confrom the outer so far as sound transmission is con-cerned, having its own walls and its own foundations. The sound chamber, which is below the level of the sround, is entered through steel doors as well as a heavy sends proof door not unlike that of a lung-retrig-ration. The sound chamber presents a spectacle of uter ankedness, due to its large size and height, with furnishings in the room which are all had lost because of the spaciousness. Three add still more impriety to a showly availed amountiers. In one corner there is an already mystic atmosphere. In one corner there is a batter; of organ pipes ranging from the little fellows with high pitched notes, down to the huge stack-like ones which roar their low notes must be nuge stack-ties ones which roar their low notes until everything seoms to quake with fear Diagonally opposite, there is a queer cabinet with hinged doors forming the shoping top, said top having a hole through which protrudes the head of any person who sits in the chair within the cabinet. In the center of the room, some distance above the floor, there is a pair of steel reflectors which turns slowly on the vertical axis and serves to change

the interference system and give a uniform distribution of sound intensity through

out the room
What manner of room is wible to talk in this show ber, since after the third our, since after the initial word is spoken the air is surcharged with the persistent echoes of the first two words, so that one is by what has already been said To speak still louder does not help matters, be-cause a moment later the

louder echoes come back and tend to drown out still more effectively what is to follow. It now dawns on one that the best procedure is to talk in a very low tone, and to wait after every few words in order to give

the echoes a chance to exhaust themselves.

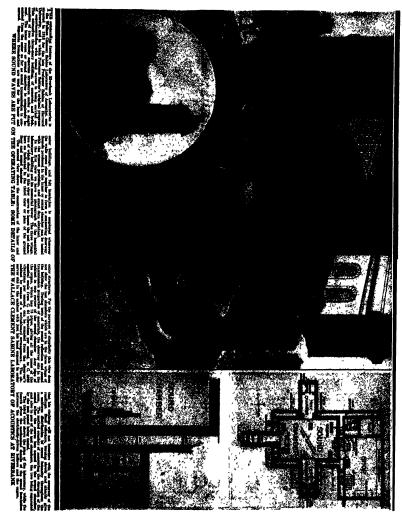
The truth of the matter is that this sound chamber is highly sound tight. It requires about twelve secby the four walls, ceiling and floor. With the sound absorption qualities of the room known and constant, ties of various materials and structures.

Now on three walls, some distance above the floor, there are doors of steel which cover the test panels. These test panels may be built up of any material or type of construction to be tried out for sound absorp-tion and sound conduction. When a panel is ready for the panel to the sound waves. The observer sits in the cubinet with just his head protruding, because it has been found that clothing has a marked effect on the absorption of sound waves. Within the cabin, the observer has a board with numerous pegs arranged in order corresponding to that of the organ pipes. Thus order corresponding to that of the organ pipes. Thus the observer on counced a settledning device with any which is present of the property of the observer of the property of the property of the property of the property of the observer is released to stop the organ pipe, and which is released to stop the organ biast. The observer is released to stop the organ biast. The observer is released to stop the organ biast. The observer is released to stop the organ biast. The observer is released to stop the organ piast. The observer is released to stop the organ biast. The observer is released to the organ piast of the o what effect the text punel has had on the sound absorp-tion qualities of the sound chamber, and makes possible the compilation of invaluable scientific data covering the sound absorption characteristics of various mate

rials and types of construction.

So much for the sound absorption experiments. The so much for the sound absorption experiments. The same arrangement is also employed for sound trans-mission experiments, so as to evolve better partitions for our apartments and homes and office buildings. It (Continued on page 821)





of weaving the cords lato a loose fabric by means of a spaced weft thread and then buttering rubber over the the cords are saked in rubber stills and dried while in ion of perfect parallelism. The cords and the rubber an integral mass and separation of the two which is all eause of a tire's downfull cannot occur while the reasons are perfectly distributed over all of the aceds

A contrast between the eid and the new methods of making cord tires

making rubber, wholly differ ent from that at present used in the rubber

industry, much less expen sive, altogether faster jet

to change the entire process of rubber manufacture. It lsis and physicists come true. It represents years of research and grasping for a wholly new method of cona wholly new method of con-verting the solid content of the rubber milk into chemically us well as physically pure rubber in such a prac-tical workable manner that the difficulties involved in the process at present used shall be done away with That method has been dis-

covered It has been tried and found not wanting Not only that, but it makes bet

Sprayed Růbber

A New Hopkinson Process of Making Rubber which May Revolutionize the Rubber Industry

By A. G. Ingalls

later and held it in the snoke of a small open fire until the milk congulated. Then the Indian of the transport of the state of the snow and the state transport of the snow and the snow and the transport of the snow and the sn basis in the rubber world

beais in the rubber world Kubber comes from the juice of several varieties of trees, but for practical purposes it will do to any that theres branklemais in the tree that furnishes what we know as real rubber. There are several other vegetable courses of rubber, or pair rubber, such as the unvisited African lessis that produces a rubber cated by the trade huston," and which is somewhat inferior. Heres bran-fluits," and which is somewhat inferior. Heres bransiliends grows wild in the tropics, especially in Brazil, but it has also been very successfully put under inten-

Inguistic and the blevelite and do the impurities may run from heave and dead hark to send and gravel, every separate let of blevelite has to be treated differently before it enters the finished product, such as the tire year by. For a such as the tire year by. For a such as the tire year by. For a such as the tire weight without adding to the work. But the buyer self-th without adding to the work. But the buyer he can be caused that the halfs is an interest of the self-th without adding to the work. But the buyer he can be caused that the halfs is a self-th without adding to the work. But the buyer he can be caused that the halfs is a provided the white man would be willing to die with fewers and provided the native could be prevailed upon to work after les hald excreed escent to buy him the few things provided the native could be prevailed upon to work after les hald excreed escent to buy him the few things within man in the Fer Blatz, and the native supply of labor, none too energetic, can be also out by the Calacsee who are found all over halarysta and bother were provided to the provided of the p

It may come as a surprise to some who well remember to some who well remember their schooldays that nearly all of the world's rubber comes today not from Bracomes today not from Bysall, but from the Far East, The Ainaxonian continues to produce at about the same old rate, but the automobile tre industry has called for greater expansion than he could accomplish The Far East rubber is all grown on plantitions in the Federated but the following the country of the far East rubber is all grown on plantitions in the Federated but the following the fol

The rubber of Malaysia is treated by the congulation process. This process has process. This process has nothing in common with the process of the Indian and his smoky fire. Neither is a large proportion of our rub



The apraying unit of the new Hopkinson process of converting rubber milk as received in tankships directly into rubber

ter rubber than the older process a stronger trude that is more enduring against age and more resistent to abrasion and wear The new process is so utterly simple and so little involved with technical and cryptic lore that one wan ders why it was not thought of long before. But hind sight is casier than foresight while the greatness of

implicity is fundamental

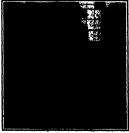
In making rubber by the Hopkinson process the suc in migring cubber by the Hopkinson process the show while rubber milk, known to the trade as later arrives at the nector, in tanks and is atomized by a simple centrifugal device. Palling to the floor through a superheated atmosphere the spray is deted instantiv making a miniature blizzard of filmy flakes and build ing up a drift of uniform textured uncontaminated. colored, spongy rubber resembling baker's

awagan Rubbs r is made in three ways. The milky juice of the tree is coagulated on the paddle of the Amazon Indian. Or it is coagulated on the plantations in pans by the addition of acetic acid and made into solid. rubber by several stages, requiring the use of heavy rollers and several cleansing processes. Thirdly, it is under by the new later spraving processes. This process is fully controlled by patents owned by a prominent rubber manufacturing concern, but these patent rights probably will be leased to all other rubber makers who

probably will be lessed to all other rubber makers who also to are then work about 22,000,000 galions of Annually in the work about 22,000,000 galions of Annually in the work about 22,000 treas of rubber ally is under up into about of false product course from Brazil. The rest comes from the Far East When we falsk of the source of the world's rubber supply we are quite ast to think of the allows all the supply we are quite ast to think of the annual that the supply we have a supply and the supply we are quite ast to think of the annual that the supply we are quite ast to think of the annual that the supply we are quite as to think of the annual that the supply we are quite as to think of the annual that the supply we are quite as the supply when the supply the supply we have the supply the supply when the supply the supply we have the supply the

directly into rubber six of the control of the cont biscuits are hought up from the natives by compradores who make their way into the wilderness to dicker with

who make there we, we the Indian Rubber made in the above manner is nearly black, owing to the smoking it gets, It usually contrains other impurities in quite appreciable and adnoying quantities, and as these quantities vary with each



we Visorove track at the belt the later is rear by use thereonly as a domainer in the facer at the later depression shows in the Sintercales. Even is no other reasons as the resulting and the R. P. M. in the deplayer and the visited into this appear in het all far more shown in the passingstand. A game's manner shown in the passingstand. A game's manner shown in the passingstand. A game's man



New type of lake and coastwise vessel of 2600 tons, designed to pass through the State Barge Canal

Sea-Going Ships for the State Barge Canal Special Type of Barge Designed for Combined Lake, Canal, and Ocean Traffic

URLING the war we illustrated a new type of vessel, combining the qualities of a designed by Mr. Mt. Dougnit, in vetera to designed by Mr. Mt. Dougnit, in vetera to carry freight through the tirest Lakes and these termseperation, which was intended to carry freight through the tirest Lakes and these to said the carry freight through the tirest Lakes and these to said the carry freight through the tirest Lakes and welland. Affilier McDought, designed two portation with A. Miller McDought, designed two portation through the Greet Lakes and Welland Chanisand the Hoden Milrey to New York and points along the with a longth of 255 feet and a beam of C. Feet and a depth of 19 feet, and they are being pullt to meet the requirements of the highest class of the American Invesse of Shipping for Greet Lakes and coast wise larges of the Coast Wise Lakes, the Guit of Mexico and the Carribeau When langthe 8 fixed Barge Canal, the ships will be louded to a dertt corresponding to a deadwight capacity will be such expenses to the carry the limited on the carribeau when langt the 8 fixed Barge Canal, the ships will be louded to a dertt corresponding to a deadwight capacity will be seen the capacity will be

about 2000 tons, and at son the capacity will be about 2800 tons. The hips have a full-length,

do uble bottom, with stowage for fuel oil and water bellast.

The vessels will be propelled by the electric drive, and the unusual feature is the system of control of propulsion units. The gas engine uili operate generators, whose current will be carried to electric motors, one on each shaft, which will be controlled atirely from the Pilot entirely from the Pilot House, both as to speed and direction, by means of controllers under the hand of the officer on watch on the bridge. The main engines will run continuously in one

trically heated, even the whistle is operated by a motor

trically heatest, even the whistle is operated by a motor instead of by steam or compressed air Refrigerated space is provided in two holds for about 600 tons of perishable cargo, the refrigerating machine, being in multiple, to facilitate centrol of temperatures as well as a measure of precaution against failure. A duplicute system of fans and ducts circulates air through chambers containing coils of pipe, through through channers containing coils or pipe, through which britise at a very low temperature is pumped, the chilled air being thence driven into and through the refrigerator holds. Perishable cargo such as dairy products, for example, can thus be maintained at products, for example, can thus be maintained at proper temperatures at all times and delivered at de-tination in perfect condition. The advantages of this arrangement, as compared with rall shipments with slow movement and frequent delays, will be apparent.

snow movement and requent deales, will be appared to the crew. The master, mates and deck crew are bettled for the crew. The master, mates and deck crew are bettled forward, and the engineers, offers and stewards aft, with battles and tollets for all. There is a three-levely hospital and a fresh water supply has been installed in conjunction with the officials of the Public Health Service. As a safeguard against contamination the supplies for drinking and cooking are drawn only from certified urces and they are entirely separate from the ablu-

tionary supply

The clearance between the surface of the canal and

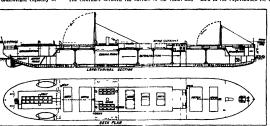
for lake service is by no means an ideal ship for de sea work, we have always believed that it would be possible to build a special type, which, structurally would have the necessary strength for both services and at the same time would operate under no serious economic handicaps, either in the lakes or on the ocean

Are Bees Color Blind?

WHAT effect has color on bees and are these various colors? This question has been investigated a number of times. The importance of the problem may not be evident after gime, but it is possible that the ability of the bee to distinguish between diff. ferent colors may have a significant bearing on the attraction that flowers have for it. This again may influence on the production of honey in a particular apinry, for unless the flowers were of the proper colors, the bees would not seek them out and gather the hone;

The bees were allowed to become accustomed to a certain color in such a manner that it indicated to them the food kept in small cups, which were arranged on paper of definite colors. Gray papers of different degrees of brightness, which must exert the same stimulus on the color blind eye as colored papers, were used in the experiments for comparative purp

order to exclude the pupers were changed frequently or they were covered with glass plates. Furthermo order that the sense of location should not be bee in conducting him to the place where the sition of the papers was clunged from time to time In the experi-ments colored papers, died with nigment colors, colors extending over quite a range of wave lengths were used In order to avaid servers which might possibly result in the experiments.



Inhoard profile and dock plan. Length 258 foet; beam 43 feet, depth 19 feet Deudweight capacity at Canal draft, 2009 tons at full sea draft. Masts and smokestacks can be lowered in the Canal

the underside of the lowest bridge structure throughout the canal is only 15 feet 6 inchey—a fact which securis for the absence of personnent mosts and decicums for the absence of personnent mosts and decicums for the absence of personnent most and decicums for the absence of the absence of

Conservative shipping men, discussing the possibility of using sabje of the Great Lake; for deep sen service, have declared that the fixing cannot be done, for the reason that dimensions, proportions and cantiling that are suitable for service on the lakes, produce a ship which is not suited for constwice and trans-occan service. Although we agree that a sinp built especially This was done by the control of the paper from which a threat of the exception of a single on several library and the control of the control of the single on the control of the single on the control of the single on the control of the single of the control of t

to discover therefrom the particular color which they had been originally besiden in to make the many that the distinguish castly and clearly vides up to him and from grown to vallow. Ultra-foliate was and distinguished. The conclusion was resched that been sure sub-to recombine the colors in guite a wifer range of the spectrum. In a recent issue we dealt with the color billind supects of several minimal.

Our Point of View

Politics in Ingineering

LWAYS it is a source of relief to engineers when the practice of their calling is un-hampered by the politician Engineering is so serious and exact a profession that its tembers have no time, and less inclination, for that grotesque and unstable thing which we call politics. The study of physics and mathematics at college, followed by the construction of bridges, earth works, power-plants and muchinery in its multiplied forms, serves to cultivate in the qualified engineer a perfect passion for cold facts, close reasoning, and straight forward procedure. The ethics of his profession, and its practice, beget in him a wholesome distuste for the shams and uncertainties of a political life. So far as the politician is concerned, the engineer asks only to be let alone, so that he may put the very best of his knowledge and experiences into the prosecution of his work

Hence it is that the recent removal of Mr Arthur P Davis from the position of Director of the United States Reclamation Service has produced positive consternation among the members of the engineering profession, for Mr Davis is an engineer of high standing, wh for an unbroken period of forty years has proved himself to be an accepted and highly capable servant of the Government. Step by step his knowledge and abilities had raised him to the position of the executive of one of the most important governmental engineering enterprises in the United States. He was removed peremptorily No adequate explanation has been given for the change, nor has he been afforded an opportunity His removal takes on a strong color of partisan politics. Not only is the unseemly precipi tation with which this distinguished and well proven servant of the public has been dismissed a matter of profound discouragement to the engineers of the coun try, but the reason which is given for the change is even more so.

The Secretary of the Interior gives as an explanation -if it can be called an explanation-that he wishes to place this great public work in charge of a business man rather than of an engineer, and without showing wherein engineering control has failed, he merely abol ishes the office of Director, and creates in its place the office of Commissioner This is mere quibble Our lead ing engineers have ever been distinguished by great business and administrative ability. But so it comes about that one of the most distinguished and successful e world's engineers in great works of reclamation gives way to a country banker who, we understand has also been a Governor of Idaho. The whole affair is at once discreditable and discouraging, discreditable, because it betrays a great lack of courtesy, and discourage ing, because it is a conspicuous instance of a movement to transfer the control of engineering works from practi cul engineers and place it in the hands of the politicians, The SCIENTIFIC AMERICAN has always contended that the interests of the country can best be served by placing engineering works under the control of engineers and removing them, as far as possible, from the baneful influence of the politicians, for these have almost in variably looked upon the responsible positions in such work as so many plums to be given to faithful followers of the party

The attitude of the average politician to the engineer, and to all treshincial mes for that matter, is one of contempt for the expert. This spirit is more often than to an expression of yelongs and dislike of the man who does not know for the man who does know Boethers of New York will not swon froget the contempts one references of our distinguished Mayor to "thougard", and though such an attitude has no more capter," and although such an attitude has no more capter, and though such an attitude has not have a such as the such a

A World Timber Famine

N A recent letter to the President of the Chamber of Commerce of the United States, the President of the American Tree Association, Mr C. L. Pack, draws attention to the warn ing of a world timber famine, which is given in the annual report of the British Forestry Commission General Levat. Chairman of this committee, is coming to the United States and Canada to ascertain what future timber supplies Great Britain may expect from North America. In his letter to the United States Chamber of Commerce, Mr Pack states that the threat of a timber famine affects not alone the British Isles but the whole world. The British forestry report states that there exists a widespread apprehension of a timber famine in the United Kingdom at no distant date. The demand for timber is constantly increasing and the virgin forests are being worked out far more rapidly than was expected. Hence, the committee wishes to ascertain what reserves of coniferous timber are available for import and how long they are likely to last.

It is evident that the question of the United States timber supply is a serious one not only for us but for Europe. In a recent article on "American Individual ism and European Recovery." It was stated that during the years 1918 to 1928 the ton miles of service in the transportation industry increased from 166,000 per worker to 240,000. To keep industry going, it is estimated that 5,000,000 trees are cut down every year. merely to provide the poles to carry the wires over which s the measures of industry, and that 200,000,000 cubic feet of wood are consumed every year in mining and quarrying These two items repre quantities, but they cover only a part of the field. We must add to them the enormous demands of the railds for ties and structural material, and of the building trades for the construction of hom tories. Another terrible source of loss, which annually cuts deeply into our forest reserves, is fire, which during a recent five-year period was remonable for the wiping out of no less than 56,000,000 acres of forest

The conditions stated above are sufficient corroboration of the statement that, unless every possible effort in the shape of protective legislation and extensive riroceration in made, not every brough the United States lived, will ultimately be brought face to face the constant amount the situation would be serious, but because of the rapid growth of population, particularly in the United States, and the equally rapid expansion of industry, the consumption of timber above an annual increase. These warrings of the American Twee Asseincrease These warrings of the American Twee Asseincrease These varings of the American Twee Asseican to one one or of "wolf, wolf!" The meanue is only no coal, and it approaches at an even-confertion possible of the property of the contraction of the pro-

Bombing United States Battleships

ATTEMET will be made the summer by the Army All Bervice to demonstrate that battles of the Army All Bervice to demonstrate that battles of the Army All Bervice to demonstrate that battles of the Army All Bervice to the Open Section 1 of the Army All Bervice to the Open General Bervice to the Open General Bettienling willington and "New Jersey," which, it will be remembered, are among those whose deterration is called for in the

Washington Treaty of Limitation
Criticism was made of the sinking of the "Outriesland" two years ago, on the ground that the vessel was
attenancy and, therefore, presented an ideal target,
In the present operations, the hattleships are to be
towed, and although their speed will not approach the
modern buttle line speed of seventeen to twenty-one
toxic, the targeties will be towed at exercial knock speed
and the difficulty of restricting a hit will be prospertionately three-seed. On the other hand, there will be
trained; but the speed of the speed of the speed
in wome measure for this the bombing planes should
be at a belief of several thought the. Reviel all the

est will be attached to this experiment because the sista use will be made of a new 4800-pound bowh containing 2000 pounds of T.N.T. So far as we know, this is the largest bomb that has ever been constructed. The aviators will attempt to drop it alongate the sligh and set the tunes so that detonation will take place fifteen or twenty feet below the surface. If they moced in doing this, there is no question that is large area of the side of these old battlessips will be blown in and their stating will be a matter of a few mixture.

Judging by their power of resistance to these Brodinnagatian optic charges (for such they are) the "Virginia" and "New Jersey," being ships of earlier design, will be easier to put down than was the "Outriesland." The "Virginia" and "New Jersey" were laid down in 1002, or some years before the dreadmapthy period. The "Outriesland" was not laid down until 1005 and great attention was paid to her underwater design, particularly with a view preserving her floation in cose of injury by torpeds. The total, therefore, will cove of injury by torpeds. The total, therefore, will resistance of the ships. We are of the ophsics that if cose of these 2000-too bombs were deconated the flee from the side of the "Maryland" and twenty-flew her below water, even that great ship, in spite of her elaborate sabilivision and the provision of gas-expansion chambers, would secously, to the attack.

Dams Versus Droughts

NE of our busiest industrial centers is to be found along the upper Hudson River, upon whose banks are paper mills, power plants and various industries, all of which derive from the flow of the river Like all stre which head in the mountains and elevated up-lands the flow of the Hudson is very variable. During periods of high water, the manufacturers see billions of sallons of water flowing by to waste, whereas in the dry season the river becomes so low that many of the mills have to be shut down and thousands of employes thrown out of work For nearly fifty years past both the State and various private agencies have been considering the advisability of storing up the flood waters and pass them down, gradually, during the dry season. Not only would such a plan prevent the periodical closing of certain factories, but it would result in the saving of some 2,000,000 tons of coal a year, which have to be burned during periods of low water to keep the larger and more important industries and power plants going During the past half century many investigations have been made of this problem, and at last a scheme has been drawn up by R. H Bargent, Enginee for the Board of the Hudson River Regulating District. dy created by the Legislature of 1921. The plan calls for the construction of sixteen storage reservoirs in the upper Hudson River watershed with a combined canacity of five hundred and ninety-three billion gallons. execution of the work would take twenty years and its total cost would be \$30,000,000 Money is to be raised ing the communities and industries that would be benefited, and fifty-year bonds backed by these communities and interests are to be issued. The plants to be afforted can develop at present a hydro-electric energy of 180,000 horsepower; but because of the droughts their continuous average output is only \$5,000 sepower. When the scheme is comp gineers claim that the flow of water in the river will be continuous and that 140,000 horsepower can be realized in these plants throughout the year.

It is one of the advantages of such reclamation. It is one of the advantages of such reclamation in the damage does by freshots will be eliminated.

Hendon River was that of March 88 and 59, 1918, when the flow was over 500,000 cubic fact a second at Albuny and about 41,000,000 worth of damage was does to various towns along the river. If the largest of the strong reservor's (that at 8 sacandags) had been in catelance, it is estimated that the peak of the flood could have been cantrolled middenty to prevent this damage.

Our Point of View

The Facts as to German Submarines

TE Navy Department appounces that it has received an authentic official report covering the facts regarding German submarines con ucted and lost during the war It repr sents some four years of work in checking official records and consulting various members of the German Admiralty In the first place, as to the total number of U boats built by the Germans during the war, the books of shipbuilding firms holding cor 281 submarines had been delivered and 197 were under struction when the Armistice was signed. As to what became of all these and the men who manned them, we learn that the losses in personnel were 5864. of whom 515 were officers. Of the submarines, 87 were accounted for by depth charges, 36 by fixed mines 20 were lost in fights with enemy submarines, engine and other troubles accounted for 14, destroyers, torpedoboats and sub-chasers sank 13, 8 were lost through accidental ramming, armed fishing craft accounted for 6, serial bombing for 6, and 6 were lost in subme nets. In addition to the above, 21 I boats were demolished to prevent their capture by the enemy

A study of the chart accompanying the report pro-vides us with the geographical distribution of the losses. and we find that 56 boats were lost in the English Channel, 26 in the North Sea, 16 off the easte of England, 16 were lost in various parts of the Mediterranean, 12 off the Dutch coast, 8 near Heligoland, 2 in Scope Flow and the remainder at widely separated points on the seven seas. The location of the loss as given above is about what the daily record of th war in the press would lead us to expect The toll of ships to be credited to the various enemies of the U boats is something of a surprise Thirty-seven boats stroyed by depth charges is about what one would look for, but that a nearly equal number were destroyed by fixed mines is surprising. If we remember ctly, seven to ten of these were credited to the great sea burrage of mines stretching from Scotland to Norway Another surprise is that 20 submarines were lost in encounters with enemy submarinwould be very interesting to know the particulars of these encounters, whether they took place below or above the surface, and whether the losses were due to gunfire, torpedo or ramning. We take it that the 18 U boats destroyed by torpedo-boat destroyers and subchasers and those destroyed by depth charges should go together, in which case fast surface craft accounted for about 50 of the total of U boats destroyed. If so, this establishes the claim of naval men during and since the war, that the most effective answer to the submarine is a fast destroyer carrying a beavy battery and a large

Super-Pressures in Steam Plants T WAS not so long ago that a pressure of 200 pounds per square inch at the boiler was con sidered to be the maximum under which a power plant could satisfactorily be operated. ares brought with them difficulties in the way of leaking joints, etc., and the quality of the material which was then available for steam piping, cyl ders, etc., set a limit upon the use of extremely high pressures. The last two decades have seen a great development in the production of high grade iron and steel, and materials have become available which, because of their strength and reliability, have encouraged steam engineers to run their boilers under increasing pressures. If you look at a list of the great p plants of this country today you will find that a boiler e of 200 pounds is comparatively rare, and that the later the date of completion of a plant the higher is the pressure employed. As to those und tion, the pressures run from 265 to 875 and 400 pounds, and there are two power plants of large capacity unde construction which will use the high pressure of 550

rends per square inch.

The objects simed at in this movement are to secure

a bigh thermodynamic efficiency and to secure that reduction in the dimensions of the turbines and atom piplus which the great density of the high-pressure ream makes possible. That the steam engineers of the country are well antiside with the re-salts sevened is proved by the action of an electric light and power cun pany in Boston, where they are about to install it str the pint in which the bottley pressure is to be not less

than 1200 pounds per square inch
As if this were not sufficient, we learn from Engineer ing that there is being built for the Willans Works at Rugby, England a steam turbine whose boiler will be operated under the amazing pressure of 2000 rounds per square inch. Commenting upon this courageous venture, our contemporary draws attention to the inter esting fact that, since, as the pressure rises the steam becomes denser, and the water, on the other hand, less dense owing to its expansion by heat, there must come a point where the steam and water will arrive at a state of equal pressure, temperature and density, or to put it another way they will become indistinguishable from one another This point is reached at a pressure of \$158 pounds per square inch and a corresponding temperature of 705 degrees Fahrenheit. At this mint. also the water can be changed to steam without any surface of separation The containing vessel may b solidly filled with water under this high pressure and temperature, since it becomes steam throughout its mass when the temperature is sufficiently high. The cycle of operation of the Rugby plant as calculated by Professor Callendar is as follows

At a pressure of \$200 pounds per square inch and a temperature of 706 degrees Fahrenhelt the volume will be 0.052 cubic feet per pound and the heat required is 820 British thermal units per pound. The steam is throttled down to 1500 pounds absolute and a corresponding temperature of 596 degrees l'abrenheit is then heated at 1500 pounds to 700 degrees Fahren helt. The steam is then expended adiabatically in a high-pressure turbine to a pressure of 250 pounds. The steam is next reheated at 250 pounds to 700 degrees I shrenhelt, and then expanded in a second turi down to a vacuum of 28 inches. The heat available for work in the two turbines is 571 B t u and the total heat supplied is 1471 B t u, giving a total over-all efficiency of about 38.8 per cent The operation of the mean turbine, so named after its inventor, will be

Decline in World's Shipbuilding

Hits dislocation of the shipbullding industry by the state of the single policy of the state of untable equilibrium tries of all countries in such a state of untable equilibrium control of the state of untable equilibrium control of the state of the state of the shipbullding yards, particularly in the Dintel Sinter, carried the world's total of shipbullding to a point far above the demands for curron since, even in normal times. Except in this country, where the shipbullders decided to consider the shipbullding to a point of the shipbullding to a point of the shipbullding and the shipbullding and the shipbullding to a more past few years the shipbullding yards of the world have been in a rather bad way.

The last report of Lloyd's Register of Shipping covering the quarter ending Jume 30, shows that on that date the shipping yords of the world had a total of 205,000 great stone of work, which is a declise of 50,000 tone below the figure for the previous quarter Britain and Ireland lead with 1,338,000 tone, then in their order foliotic Otenany, 104,000 tones, then in their order foliotic Otenany, 104,000 tones, Then, 170,000 tone, 171,141,000 tones, 104,000 tones, 104,

German merchant fleet, by the handing over of the largest and choicest part of it to the Allies as part of her reparations.

Comparing the above figures with those for the last quarter of 130H prior to the war, we find that the United States yards were building 15,000 tons less during the last quarter of the present year and the Dittish yards about 400 000 tons less. Since shipbuilding affords a reliable index to world prosperity, it is evident that there is a long way to go before industrial would be a superior perior of the present years of the present years.

Seventy-five Years Ago

NOM the earliest days of railroad travet, the interest Thus in our issue of September 9, 18 for telesch article that public interest Thus in our issue of September 9, 18 for secondard that a new engine, with season of the season of the telesch diving whoch, public a train of the passes of the season of the se

That 75 years is sufficient to earry us back to the beginning of things is realised when we read as follows "The City of Providence is taking measures to lightle its streets with gas. The Almy Gas Light Company have commenced laving pipes and putting up fixtures. The place having been heretofore badly lighted, the inlabilisatic evinced great by at the new way of illumina

And while on the subject of modest heginnings, take note of the following "Very few railroads in this country can show greater percentage of increase in their receipts of the last six months than the Macca & Western Railroad of Georgia From a statement just published, it appears that the total receipts for August, 1848, were \$12,476 and August, 1847, \$9,441.

The August editorial page opens with an announces of the discovery of an insurance bed of gold, (30) miles in extent, on the Fork and Feathers River, Galling Fortal. The gold is recovered by "sushing out the sand, in any wosed from a ten anners to a warming par 10. Annothing the still the Annothing the still part of the Annothing the Annoth

How many of our reciders are aware that the Datted States New, 77 years ago, made a nursey of the filter Jordan and the Dead Sea. As told by Lieutenant Moury, the story reside filte a remace. Two metallic boats, use of copyer and the other of low, were transported over the mountains and launched on the Sea of Gallott Milles was not spitted until a survey of its bottom nade. The deepast sounding made was 1128 feet. There is nothing that the New yearand do. Well might the follow exclaim. "It is a specimen of the abilities you've and deeplate of the American the abilities when and discipline of the American

Wery interesting is a letter in the September issue from Klian How, it, of sewing meeting fame, issue from London, which opens time "I am in the requise receipt of your valuable peaper (through my father in Cambridge, Mans.)," and goes on to give particulars of a French swing meetine which had appeared in an earlier issue. The letter proceeds "I wish to say to your correspondent that I expect soon to submit a sewing meetine which will stirtly and sew in the same number as is done by hand. "Howe had just that "John Hull is thick upon some matters, and upon that seel in decidedity thick."

Out of Chaos Bringing Order The Emergency Job of Reconstruction after Philadelphia's Station Fire A. McGarry

ROBABLY without parallel for sheer speed in pence-time experience was the engi-neering feat accomplished recently at Broad Street Station Philadelphia Passtages in and out of that terminal of the Pennsylvania Balirond look up today at the vanishing remains of a rusted fire blackened steel skelt in that once supported the largest arched train shed roof in the United States. They see little figures of men swettning about with ony acetylene torches 150 feet in the dr to cut away the twisted gliders crunes drop ping them to flat cars and the latter moving in and out with no interruption to the regular train service They probably marvel at the efficiency of a system that can run a train a minute under such circumstances But the task today is relatively simple compared to what we done in three days after the train shed

Broad Street Station stands at the juncture of West Prin Square and Market Street. The Prinsi Ivania main lines run directly west from their on an elevated structure paralleling Market Street Fifteenth Street is crossed by girders carrying the passenger platform just outside the gates the elevated structure is carried over all other cross streets by brick arches. The station occupying the space between Penn Square and Fif

Virtually all the space under the elevated structure between the cross streets is utilized by the inflrond or nilled services. The surface of the road was carried within the shed on ties set in concrete which rested in union as girde system. When that was built 20 verses as of twest quite adequate to carry the rolling stock than in use. But as equipment because heavier the company found in the company found its treestern from time to time to strengthen the supports of the tracks. To that end steel and wooden uptights and girders had been put under the eld work. Beneath the concrete of the train floor was six feet of this heavy wood work boxed in from below by the cellings of storehouses, engine rooms post office sub station baggage rooms etc. I ikewise although the roof appeared to be of steel

and glass there was quite a bit of timber in it and much far paper and similarly inflammable material The fire started at 11 %p m on Sunday June 10th with a trickle of smoke under the platform between

with a tricke or snioke under the juncks 11 and 12 and at first it seemed a simple task for the station fluence to check it. Within fix min uits however they had discovered that the bluse had gone down into the pure time of the present that the pure how the tracks. and within an hour 25 city fire-fighting companies had arrived and all the apparatus in the city had been shift d fied By that time the burning wires had disrupted telegraph of whise had disrupted telegraph telephone shand and train starting systems and fite in the engine rooms had put out of struke the alt comparessors for the operation of the switches and nearly every other phone of the terminal system. The fire swept the whole length and like this children is the starting to the starting the system. be tith of the great shed in the area beneath the tracks and over the sur face platferms crawled up the steel and brick walls and shot hundreds of feet in the air us it licked lis was netures the neres of glass above

the interior of the shed was obvi ously untenable for human life with toke flame and melting glass. But somehow railroad workers operating

tracks in the world got into that shed with switching engines often enough to drag out a string of sleepers bound for Boston and filled with slumbering passengers, most of whom knew nothing of the fire until they arrived in the Hub the next morning They also saved all but 21 passenger conclus and three locomotives. In the meantime the fire had jumped a hundred free rows Warket Street to the upper floors of a strel skeleton which is to be a theater and office building and burned out six floors of timber forms. out six floors of timber forms for concrete
At that time when experienced firemen were begin



After the blaze-a locomotive delicately balanced

ning to talk of dynamite to prevent a possible city wide confingration, when fire crows had been called out by a dozen skyscrupers and when the station itself seemed doomed the work of recenstruction started nowed circuits calls began to go out for division engi neers supervisors, master carpenters trainmasters and all sorts of technical experts also for section gauge nd common labor Heads of employment

and common labor. Heads of employment agencies and supply houses were varied out of bed at three oclock to take orders for heat and naterials of the orders for heat and naterials of the control of clothes 'shifting crows and section gamps became smoke enters to do that handling red hor materials with all seriot to improvised tonges at the very edge of the burning area, hearing up platforms still hurning and otherwise matting way for new construction. In the meantime other forces were preparing new schedules to use improvised stations in various quarters of the city for the handling of passengers over the commut ing lines

By dathreak a group of men out beyond the fire area near Seventeenth Street had gone to work on the brick retaining walls overlooking Market Street on one brick retaining waiss oversoming anract street on one side and lither Street on the other. In a short time it because evident they were constructing temporary star ways. At about the same time shifting captines began to crawl over the network of tracks with loads of shed was at its west on Monday aftersoon, competing the destruction of vites, componend all and stabilish out On Wednesday 151 were bandled. Thursday enough tracks had been straightened out to run 344, and on Friday and Saturday 275 trains were cared for its the rulned station. In just size days all attems receibs were restored and ready for service, and 2500 the 530 trains normally operated out of the term were running on regular schedule. It was not pos

nero ruming on regular achedulos. It was not possible to bring in the others because it was necessary to use from four to six tracks for the reconstruction work from four to six tracks for the reconstruction work shifts Monday, and that number was increased to nearly 8000 three days later, when the worst of the overgency task was concluded. All that has been de-scribed, however, was pure or less simple compared to its accomplishment undermeath the train favor in which

the accompliatement undermeath the train foor in which every phase of engineering was brought listo blay. Before a single train could be run up to the gates it. By the time the could be run up to the gates it. By the time the sucke had been cleared out of the shed it was found that one locomotive had falles partly through the cantere floor, bringing up in presentous balance across a few partly burned girders. The floor was not strong enough even the electric subordan and strong enough even the the electric subordan.

equipment
Early on Monday morning the lumber ; ards were
delivering timbers into the side streets just beyond the
danger area, and before noon a half dome portable
sawnills arrived It was not then possible to invade aswmiles arrived. It was not then possible to investe the whole area undernath, but men managed to get into partly cooled and burned-out sections in order to shore up a truck or two. After thesm-or rather with them—went the electricians. In some instances they succeeded in forestailing the fire cutting into cables out on the line and carrying emergency loops into the station. The railroad owns the property paralleling its line on the north, and over the tops of these were strong by daybrask more than 400 pairs. As soon as the ruins had cooled enough these were hunched and carried through windows into the twintant room.

A list of the electrical work would read like a catalog Suffice it to say that in seventy hours after the first first started the train starting system was recentabilished with indicators on all the tracks, the telephone and telegraph lines temporarily shifted to West Philadelphia

upornith shifted to west rinisceiphia were operating out of the main offices in Broad Street, and all the other complex parts of the system were in working order in so far as wires were concerned The power restoration was just as rapid. It should be stated that the railroad runs comstated that the railroad runs commerce trains as two of its most beavily traveled lines by electricity. For the convenient handling of these trains every track of the sixteen in the train shee had an overbead trolley wire, and naturally all of these cause down, together with much of the side supports. Workson ar-ticle side supports. Workson ar-ports, a foot at a time, following the smoke, and later put in more perma-nent stanchings.

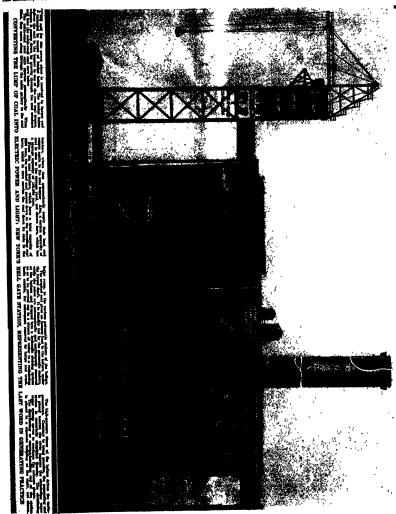
The story of how the old train she

here state-times. Note that the sheet is being renormed in almo of the tender in the being renormed in almo of the tender if it does a gaust and virtied discheduling rained and officials had long realized the state of the stat



General view of the wreckage in the Pennsylvania Terminal in Philadelphia, with the electricians patching up the nerves of the train-control system

cinders and timber, and a proving force of carpenteer got to work hydrag platforms right up to the edge of government of the platform right up to the edge of governs started entryping ever tillning loose from the train-shed root. In spite of the new fire maring underseath, platforms of some kinds over, showed up to the train platforms of some kinds over, showed up to the train platforms of some kinds over, showed up to the train of the showed with the showed to be the showed by the showed by the showed by the number of trains operated. It should be borned in minfo that the second five bearing underseath the



The Bureau of Standards test automobile, equippe features of resoline performance and car economy

HE automobile engine may be tested in the laboratory, under ideal conditions, but it must run on the road under condi-tions far from ideal. When traveling along the highway at a speed of forty miles per hour, more or less, the behavior of our and engine presents so many aspects that, for their competent observation, more observers would be required than could possibly be packed aboard the car It is in this emergency that the inventive faculty is called into play, the Bureau of Standards has recently devised an apparatus that automatically and autograph cords the action of the car, in sixteen sep particulars, requiring at most the attention of one or two operators in addition to the driver. This makes it possible to conduct road tests on a basis never before

dreamed of, as regards both accuracy and completen The rate of flow of gosoline in an automotive engine is an index to the rate of energy input

is an index to the rate or energy then, the first object was to find a suitable instrument for determin-ing the flow of the gasoline A flow meter was selected comprised of a vertical tube slotted purallel to the selection. to its axis. A light piston moves vertically in the tube Gasoline flowing freely out of the slot below the piston into a ring shaped squee through which the post of the piston may be seen. The pointer affixed to the piston, moving over a vertical scale on the central tube, indicates the effective length of the slot. Knowing the pressure, the re through which the position this, and knowing the pressure, the

This is measured. Preliminary experiments in Preliminary experiments in an image of the scale and pointer of the flow-meter on a moving film. The builtiness of this type of firm meter entern operated to a classificating, said the design was displaced by one in which the camera traces lines of the scale and pointer by means of shadows on n roll of brombe paper. Time intervals are controlled from a contact mounted on the tachometer of the car, and these are impressed on the fuel-flow film by the alternating increase and decrease in the intensity of the illumination on the bromide or sensitized paper

How much energy or thrust does it require to move a automobile on a level highway, down hill, or upan autonomic on a level nigmwhy, down nut, or up-grade? The upparatus described replied to this ques-tion in terms of the power output of the engine. An accelerometer was employed, which is essentially an instrument for measuring the force acting on a "free body" to supply the latter with the constant increased velocity which is to be accurately determined. Such a appraises the linear acceleration, positive o of the automobile mass, and takes account negative.

both of the velocity and of the gravitation factor.

The "free body" employed in the particular access erometer used in these experiments consisted of a column of mercury mounted parallel to the wheel base of the motorized vehicle. The gage element an abbreviated connecting tube, as well as the space above the closed end of the mercury column, were filled with a light oil of the mercury column, were slied with a light oil when the tube containing the mercury column is at ted upon by an increased velocity parallel to its long axis, a hydrostatic pressure is exerted in the oil, thus balanc-ing the force required to accelerate the mercury. This

Sixteen-to-One Automobile Testing

Extraordinary Assembly of Apparatus for Making Many Tests on a Single Run of a Motor Car

By S. R. Winters

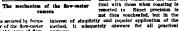
sure is recorded by a pen-arm affixed to the compression element. Oil is an agent of press mittal which not only minimizes the mot mercury but reduces the lag of time in the instrument Automotive engineers are familiar with the formula relating to the operation of an automobile, namely, that power at the clutch required to propel the

vehicle is the aggregate power needed to overcome he a dozen counter forces. First, of course, is the force a doesn counter nores. First, of course, is the force-mensured as the product of the mass and its linear acceleration—necessary to overcome the inertia of the car. Then we have the mechanical friction losses— that is, the energy squandered in the transmission, uni-versal, differential, rear axies, and wheel barriage, the tire-rolling losses, the energy consumed in overcoming

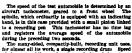
windage, that employed to fight the gravitational pull in climbing grades, and that which is used up in developing the angular acceler ation of rotating parts. The accelerometer, however, when funcpropelled over the highway, conportion of the power expenditure portion of the power expenditure of an engine necessary to overof an engine necessary to overorder of the power of the power of the power transmission, tire losses,
sundage, and rotational inertia—may be measured by
this instrument as a negative acceleration. This of

0

to coast in neutral Friction wastage in the engine
may be taken cognizance of by
coasting with the clutch engaged over the transmission in gear The energy absorbed and yielded by the angular accelerations is primarily reposed in the wheels and this expenditure of power may be ulated from the changes in the hine or wheel speed The momachine or wheel speed ment of inertia of the whe be determined directly by the pen-dulum method. Buch a method of measurement acts upon the as-sumption that the readings of rolling and frictional resistances under power conditions are iden-



"The wind bloweth where it listeth," is a Biblical observation that is necessarily recognized in any experiments the ognised in any experiments that would accurately reflect the cendi tions under which a motor-propelled vehicle operates. Both the velocity and direction of wind exercise an influence on the motor-cur in action. Acceleration measurements, in the interest of accuracy, have to include the appead as well as the course of the wind. The direction of the latter



for nimest all its work, a single recording drain. Speed of the automobile, acceleration, velocity of the atmos-pheric current, direction of the wind, manifold pressure, water-outlet temperatures, water-inlet temperature, oil temperature, carburcter-air temperature, transission lubricant temperature, differential-lubricant tempera-ture, weight of air used by the engine, fuel temperature

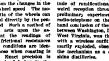
and air temperature are all graphed, in inks of varying colors, graphed, in inks of varying colors, on a single strip of paper, moving at a non-variable speed of one-tenth of an inch per accound. The paper supply is adequate for an uninterrupted service of one hour The gusoline flow meter camera is a separate unit, a 12-exposure todak film being used for retain-

ing the impression.

The faithful observations of this humanised recording unit are at tuned in harmony with the records

tuned in narmony with the records
of the flow-meter, this delicate
adjustment being made by individual timing devices
placed on each of these instruments and driven by a
single time-cuttact on the tachemeter. The recorded single line-cutact on the tachometer. The recorded observations are made on unruled paper and the readings are made by use of celluloid template, oriented into position by reference points and lines, and marked with the cullivated pen paths. The supply of paper, record roll, and the driving element, constitute one unit.

record roil, and the unving esement, constitute use unit and its removal for rebuiding is possible without up-setting the testing portions of the apparatus. Little wonder is it that this test car, with its multi-tude of rumifications, should have been accorded a weird reception through the rural sections in which preliminar; experiments were conducted. With the radio-telephone on the crest of its popularity, the off-hand conclusion of the spectators alongside the highway annu continuous of the spectators alonguide the highway between Washington, D. C., and White Sulphur Springs, West Virginia, was that this automobile was equipped with a wireless outfit. This theory having less sum-marily exploded, observers were wont to characterise the neclamism as a creation for ferreting out moon-shine distilleries.



Diagrammatic sketch of the accelerometer



High-Altitude Mountaineering

IN the Geographical Journal for March, 1923, Mr G
I Finch presents some of his findings on the physiology of high-altitude mountaineering. Mr Finch bases
his conclusions on his experience
in climbing Mount Everest. Up to
21,000 feet the climber's physical
functions were found to be pracfunctions were found to be prac-tically unimparted and good sleep and recuperation from fatigue were possible, but at 22,000 feet sleep was fittal, appetite fell off, and there was a general loss of physical fitness. The conclusion is that at, say, 22,000 feet accilimati-sation to allitude cances and above is a Time direction of the latter in relating to the invested of the invested

The Trial Trip of the "Leviathan"

A Five-Day Test of the Motive Power, Equipment and Operating Staff



This was the third trial trip of the "Leviathan" The first took place in the North Sea, in the early sum-mer of 1914, when she was fresh from the builder's hands, and, as in the recent test, she carried a large number of invited guests. The next trial was made after her heavy transformation into a transport for American troops during the war. The present lengthy American troops during the war. The present lengthy trial was rendered necessary by the extensite overhaul of the mala engines, the change of the boiler plant from coal to oll-branding, the complete revenstrated nor a large part of the passenger accommodations the rede-cration and orbanishing of the whole ship, the substitu-tion of entirety new lighting, lenting and plumbing systems, and the general reconstration of the weithin

All practical shipping men know that the responsi-bilities and strain upon the operating staff of a large ocean liner increase more rapidly than the increase in ocean mer merease more rapun; man me increase in the size of the ship and they will agree that the de-cision to give this great vessel, upon whose recondition ing over \$8,000,000 had been expended an extended trial, under conditions similar to those of a regular transatiantic passage, was a wise and necessary pre-caution. Although the most important trial was that of the motive power, a thorough test was made also, of every part of the equipment and of every department of the personnel. The program of the trial, as handed out to the guests, called for the swinging out of the ats by the crew, dally bout musters for the crew inte-sound by time evew, unity four minuters for the evew with the purseongers assembled with life-preservers on fire drills with operation of the hose and closing of watertight fire doors, tests of the Rich fire-detecting system covering the holds to say nothing of tests of erful Sperry searchlight of 450,000 000 candleer on the foremost, and of whistles, sirens, telegraphs, ventilating systems-257 in number-salt- and fresh-water sanitary systems, and a score of other ele-ments in the makeup of a giant, high-speed liner—that most compilented of modern constructions.

The plan of the trial called for a gradual working

up of the power from that represented by 150 revolu-tions of the propellers at the start, to the final opera tions of the propellers at the start, to the final opera-tion of the ship is maximum power for a period of Zi tion of the ship is a maximum power for a period of Zi 150 per unique. This was maintained for 12 hours, the chemical staff taking engine-room data for the last four hours of the twelve. The sevolutions were then gradu power of the twelve the resolutions were then gradu of the twelve the sevolutions were then gradu of the twelve the sevolutions were then gradu of the twelve the sevolutions were then gradu of the twelve the twelve the twelve the twelve for successive periods, the revolutions were increased to 170, 173, 185, 185, and finally for the maximum, with all burners going, if necessary, in all of the maximum, with all burners going, if necessary, in all of the 46 bollers. It should be noted that, unlike the Cunard and White Star ships, which use the low pressure White burner, the "Leviathan's" bolter plant is equipped with the

the "Leviathan's" botter plant is equipped with the Poshody high pressure burner, an American type, which gave excellent results throughout the trial There was fog on the first night out, and this caused the ship to full several hours behind her schedule. She tree and to full several flour midnight June 21, passed at high speed through the Providence Channel, and in at high speed through the Province Commerce, and in the early morning sweet into the Gulf Stream. Turn-ing north she had Jupiter Inlet Light abeam at 7.17 A M., June 22, and, with everything wide open reached Damond Shoul Lightship at 3.99 A. M., June 23, hav-ing covered the distance of 570 miles at an average ing covered the distance of 500 miles at in average speed of 27.90 knots. Full power was maintained until the "Leviathan" reached latitude 36.02 north, longitude 74.21 west, when it was found that the ship had cov-ered a distance of 687 miles in 25 hours, at an average speed "over the ground" of 27 48 knots—a splendid performance and a world's record for a continuous 25

sour cm.

Now it detracts nothing from the merit of this performance to resulted our readers that this does not mean that the "Leviathan" is a 27½ to 28-knot ship in still water. To get at her actual speed we must make a deduction for the speed of the Gulf Stream, in the axis

of which she was running, and an addition must be unde to her speed to compensate for the loss of power due to the high temperature, 85 degrees, of the sea-water which was passing through her contensors.

A study of the current charts of the Hydrographic Bureau of the United States Navy shows that at this period of the year the Gulf Stream runs at a speed of 8½ to 4 knots off the southerly coast of Florida and diminishes in speed as it spreads out to the northeast The average speed over the 25-hour course, taking account of the high temperature, was probably about 2.75 knots. Deducting this, we get a speed of about

On the other hand, if the speed of the Guif Stream On the orise hand, it the speed of the Guif Stream was a help, it is high temperature of 85 degrees was a hindrance to the speed of the 'Leviathan' The nor noil sea temperature is 65 degrees and that rise of 20 degrees played all sorts of mischief with the vacuum —and a high vacuum, be it remembered, is all important in developing the full power of a steam turbine. With sea water at 65 degrees the "Leviathan would have shown at least 28 inches at the condenser, and this



Trial course of S. S. "Leviathan ' Full-power run was made from Jupiter Inlet to latitude 36.52 north

would have meant an addition of 0.75 knots to her ed, raising it to 25.48 knots

speed, raising it to 25.48 knots. If, at the end of the 25 hours, the "Leviathan" had turned and run back over the course, and the same conditions of no wind and culm sea had obtained, the current effect would have been eliminated, and the actual speed would have been eliminated, and the netural speed would have been determined with great accuracy. This method is used in all our warning trible over the newspace of the 25 Evelinate, the vessel with the condition of the same control of the condition of the condit being run alternately with and against the current, the mean speed, as thus obtained, being the actual an through the water

As a check upon the above calculations, in which the speed of the Gulf Stream is necessarily no more than an approximation, we have available the closely ac-curate method of determining the speed of a ship by curate method or occremining the speed of a supply the revolutions of the propellers. Applying this to the "Leviathun," we find that the pitch of her pro-pellers is 14.88 feet, and that the average revolutions for the 25-hour run were 184 per minute, 80, 14.98 for the 25-hour run were 184 per minute. 80, 14.88; olicila x 184 (average reconsiston per minute) x 60 (minutes per hour) gives us the distance the propellers would move through the varier in one hour if the water were rigid. Dividing this by 6080 (one knot) we get the speed in knots per hour. But because of its finidity the water is driven rearwardly in a variable proportion to the forward motion of the ship. This, subject to

ence has shown that, in average weather, with propellerence has shown that, in average weather, with properties suitable to the ship's form, etc. the slip is about 10 per cent. Making a 10-per-cent reduction, we arrive at an average of 24.38 knots for the 22-hour run. But the "Leviantum" was using cooling water in her condensers withit varied in temperature from 85 degreess.

at the commencement of the run to 78 degrees at its at the commencement of the run to 78 degrees at 18 close, and this had the effect of pulling down the vacuum to as low as 20.5 in hee during the first few hours of the trial. Had water been available at 65 degrees it would have been possible to hold the vacuum. at 28 Inches, as was done in the cool water off Boston at the start, in which case about 0.75 of a knot would have been added to the speed. Thus we arrive at 25.14 knots as the speed of the ship through still water.

From these considerations we are led to the opinion that, in a series of runs, with and against the tide, in deep water, the "Leviathan" when she has been thor-oughly shuken down, would be capable of making a speed of 25.25 to 25.50 knots over the measured mile The "Majestic" (six feet longer and with two more bollers) has averaged 24.70 knots from Ambrose Light to Cherhourg, hence we may look for a spirited ocean contest between these fine ships When we bear in mind that the "Leviathan" during

the intervening ten years since her launching in 1918, had seen only about eighteen months of service, and that she had spent over eight years hing idle in the water, it will be agreed that the fine results achieved in this trial are a great credit to the Gibbs Brothers, who laid out and supervised, and to the Newport News Company who executed the reconditioning and (in all fairness let us add) to the original builders of this

Dynamiting Bedrock Over a Subway Tunnel in New York Harbor

Directly over a submay tunnel under New York unnel and the river bottom above, charges of one bundred wounds of dynamite are daily being exploded the slightest injury to the tunnel or to the subway trains which pass along its length at frequent intervals. Diamond Beef lies in the bed of the East Itiver, just above the old Brooklyn Bridge, and rises to within thirty feet of the surface at low tide. In order that the largest battleships may pass this point and that the introck swittlessings may pass this point and enter the Brooklyn Navy Yard, as well as to permit the passage of the deep draft vessels now so largely in sea in the merchant marine, the channel must be despresed to forty feet. The obstructing reef is of solid rock of a very tough variety, so that before the exrock or a very tough variety, so that netwer the ex-plosits can work against it to good advantage it must be placed in holes drilled in the rock to a depth of ten feet. This drilling must, of course, be done from a sow on the surface of the water, and it is essential that means be provided for holding the sow rigidly in that means be provided for holding the secov rigidly in place when the titles and swith from passing barbor ingo batter it. The sew is equipped with vertical ward until they rest on the bottom. In addition to this, by means of racks and phicoss moved by small backgeared steam engines it is possible to raise the scow bodily, not clear out of the water, but some dis-tunce above its normal level of fination. For all prac-tures when the normal level of fination. tince induce its normal level of notation. For all prac-tical purposes the seven is now no longer a seow, but a temporary platform on legs and the drilling may proceed with the assurance that the drills will not be thrown out of line above the holes. A battery of three chura drills is mounted on the seow and the holes are sunk to a depth of ten feet on ten foot centers. The seew or drillbont now backs away about seventy five feet, the charges of 80 or 90 per cent gelatin are packed into lengths of common galvanised fron leader pipe and

into lengths of common garvanness from sensor paper and these are lowered into the holes. When the charges have been connected in series by the tires used for electric detonation, the charges are the wires used for electric decoation, the charges are ready to be fired. Certain precautions must now be taken. On broad principles of safety it is necessary to nevertain that no subway trains are in the section of the subway beneath the river. This is made known by a system of electric signaling that was installed for this purpose. Trains are prevented from entering the tunnel and those that happen to be in it are allowed to s through Then the signal is given and the charge is fired. Surprisingly it has been found that so little tremor is felt in the subway only thirty feet beneath the point of the explosions that a glass of water placed on the floor of the tube as a test trembles but slightly

Psychic Adventures at Home

The American Supplement to My European Expedition: A Sitting with Ada Besinnet By J. Malcolm Bird

Associate Editor, Scientific American, and Secretary of the Scientific American Psychic Investigation Committee



HILD be was in Now York in April, Mit thin Cham I was in Now York in April, Mit the Cham I who exampled that he middle be able to arrange for me, with middle be able to a rrange for me, with middle be able to the same with the control of the same was to the same was to middle the cham I will be able to the same was to middle the cham I will be able to the same was to middle the cham I will be able to the same was the middle to the same was the

26 for a sitting with Miss

Ada M Besinnet Miss B, as I shall call her for econ omy a sake is regarded by spiritualists as one of the world's foremost mediums the seance was held in

the dining room of Dr John the dining room of Dr John S. Psic s residence, at 1064 Prospect Street. Dr Pyle is one of Toledo's leading med kal practitioners. He has known Miss B from the age her mediumship develop from its earliest stiges with an interest which seems to be in equal parts friend by professional and selen Of the other members of the group whose names appear on the diagram spe cial montion must be made of the Rev. Horace West wood paster of the Lirst Unitarian Church of Loledo who has for some time been interested in Miss B's me diumship and who was one of those who defended her

ox mose who detended her against MI Black at this time last year. Mr W W Roche of the Toledo Acuse Bee, is known to our readers in this same way Save for myself in fact, all the sitters were close friends of the medium and fairly frequent sitters with her, so from the spiritualist viewpoint a brilliantity successful seance could be an

The party assembled early, Miss B likes a bit of so ini contact beforehand, to get an atmosphere. The Pyles live in a thoroughly typical detached cottage of the sort found in the outlying residence districts of American cities—"villa" is the word for my European the sort found in the outging resonance marries of American ethics—willia is the word for my Duropsen, raders. Considerable preparation was involved, in which all hands joined I watched carefully for evidence that certain tasks were done by certain people that fundative was placed in particular spots etc, and found nothing whatever of this sort of suspicious details.

Miss B requires total darkness. The two windows were sealed by means of dark curtains fitted close to the glass outside the conventional dark shades. The living room, wide open to the street through a door and liking room, side open to the street through a door and numerous valued, equal to twell be darkered. If joinst like disting room through a wide open doorsan-ty and hung in this opening. Along one side of the up was a series of losps, with nails to match along the wall shave the frame of the doorsaw. The rug was adjusted with complete success, dutting off all light from the frant of the house I was informed that while senness had been held at the Pyle house before, they are by no means so frequent as this preparedness might lead one to suppose

The dining room contained an extension table, a

The duning room contained an extension ratio, a smaller table in one corner with a vacuum tube radio outfit on it a large china closet and a cabinet phonograph of these articles, only the phonograph was moved from its permanust place. The dining room chairs were supplemented from other rooms.

Miss its controls demand a 'solid' inble. The ex-

tension table, whether the leaves he left in or taken out, has one or more joints which violate this requireout, nas one or more junts wante violate this requirement. So it is opened as though several leaves were to be inserted, and the operators are pt this as the equivalent of two separate "soil!" tables. The medium them vits, not really at the table at all, but at the opening its flag table. better access to all parts of the table and circle than she would have with a more conventional arrangement. The extent to which she could circulate in and out of the well in the center of the table is, of course, entirely publicantial. The "runners" along which the table slides and which hold the two ends togeth hinder this in some ways, and I suspect in others they would facilitate it.

Miss B has phonograph guisic throughout her sittings.

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Living Koom Doorway

ne two chairs bracketed under the names of Str thur Conan Doyle and Mr Bird ware occupied alternation by these two sitters who on three casions during the seames were instructed by the introls to exchange seats. Miss B was the medium

Arrangement of the sitters and the furni-

panying article

upon their familiar and favoitie airs, she curries her own records with herman experience of the control them to Lugiand. Their unpacking was delegated to me Frage suitease I removed some fifty large and small accords of the disk type, two tambourhes, a sectional frumpet of cheap leather or heavy cardiagrad, a writer heavy cardiagrad as writer upon their familiar and heavy cardboard, a writing tublet, a pencil, and about ten yards of rope in two pieces. All this was piled indiscriminately upon the table, then Miss B sorted the records out into three groups—vocal, and loud and soft instru-

The phonograph was at the medium's left, where there was barely room for it between table and china closet it seemed an effective barrier against her moving about in that direction

ing about in that direction.
The privilege of tending it during the seance was of ferred me and declined on the ground that it would take too much of my attention. On the whole this was fered me and declined on the ground that it would take too made of my attention. On the whole this was a vise decision, but there were moments when I wished should take this position at one of the distings I should take this position at least the continue of the finally assigned to Mrs. Lee the rest of the company and as diagrammed. There was no physical obstacle sanitant the medium's moving about to her right, but Ny Arthur and I observed no evidence that the was

Miss B's controls are two in number Pansy, a little girl, and Black Cloud, the inevitable Indian, Pansy inevitable Indian. Pans; speaks in a lisping childish tone, Black Cloud throws in tone, Black Cond throws in two or three words at a time in staccato grants. Both are apt to rap instead of speaking, if what they have to say is cowred by the code Like a good Indian, Black Cloud is hard to annaw, but he finds white squares more to be laughed at than the generality of things and he laughs at them by gently shaking the table

Hands were placed, fist and unjoined, on the table and we were insured that the centrels would reserven; them showever they wasted lights were rejected by single red bells, this was actuallizable and the searce was on At Intervals, one of the sitters would ask, "Are vou here, data" After perhaps five minutes the question failed to elicit an answer, so someone saked to very fully a profit of the searce was considered to the searce of the searce was considered to the searce was considered to the searce where the searce would ask, the work of the searce was considered to the searce where the searce was considered to the searce where the searce was considered to the searce was the searce where the searce was the searce of the searce was the searce wa

in very faint raps.

Before the medium was thus marked as having a under, lights appeared, quite bright and of considerable range and speed of travel. I was told that this was usual. After the controls had taken charge, the lights

presented for me to put my ear to, verifying that the voice was not in it, and most certainly it was not. Without exception the voices had the touch of personal Without acception the volces had the tonch of personal characteristics, thus, one fremate volce had a distinct Irish lilt. There was a prodigious rich tonce, esticlant in volume to fill a certheria! This particular singer has a name—be is Dan, and he attends all him five has a name—be is Dan, and he attends all him five has a name—be in Dan, and he attends all him five has a name—be in Dan. The particular singer has a name—be in Dan. Be the first training the second point of the produce Dan's colonial volce, one would stumble over the assumption that one person could have such in runge And I have never tunes were carried by the volation that came from this content of the third produce Dan's of the produce Dan's content of the volation that came from the center of the table.

times were carried by the whistle that came from the center of the table Mrs. Lee had the phonograph records piled before her. And It was her duty to keep the machine wound and supplied with records On the second or third record attempted, the massle was cut of inmediately it started, plained, in answer to questions, that he wanted a notire record Throughout the senses when a record was stopped, the motor wound, the lid raised or lowered to late the volume, or a record put on or taken off, Mrs. Lee would raise when the cond. Mrs. Lee would raise when the cond. Mrs. when she entered a disclaimer, Dr. Westrood was able to assert that he was in contact with both her hands. Quite untal was stoppage of the meshine and rejection. The control is not seen which not of record they washed. Once we had something fairly evidential, the motor was wound "discondening when the needienn was a was a seen of the control is not seen the control in the contro

that was quite linandhie to the others and almost no to the one addressed. There was also a performance with the tambourines. One of paint, by vitres of which one could follow it as it travelled about above the table, in and out over the heeds of the effects. While heeds of the effects, while accompanisment to the plenograph tune; one of the ladder remarked that she had not realized that such a table of the realized to agree. The tame-

NRE than sace we have posted out, in a blace like the present one the distinction between Mr. Blird's parsonal and informal examination of medium, and the formal tests curried out by his cosmittee. Heretofore, there has been a geographic beaus for the datancies, in that the informal work had all been done in Europe Wall the present unione, the geographic beauthous the same of the had been done in Europe borner is broken down, we have Mr. Blird had been done in Europe borner is broken down, we have Mr. Blird helding an informal seames with an American medium, in America. It therefore becomes doubly important sometim to must, as he had sone, upon the fact that the sating pose not green studiedly with them. Mis Blistings has not green studiedly with them. Mis Blistings has not green in fact, so the reservation must be made on her behalf as well as on our.—This EDITOR.

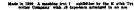
Miss Bearinest has not agrees to at with them, the mean the made or can on our.—This the mean the made or can on our.—This the mean the made or can on our.—This the mean the made or the mean of the mean out of the mean of













y pears oil The samed Scholer and thicker who after some thirty or using a capital or well as usual lett to e here have been supported by the same of granulating in 1871. This was the found then of the until the type reference we key it it all y we see all the 1716 The lett.

1716 The lett.

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1720 The

Keeping the Ash in Motion

Continuous Mechanical Discharge of the Unburned Residue, and Its Role in Boiler Efficiency

By David C. Spencer



NE of the problems which constantly con front bolter room engineers and operators, is the matter of cleaning first and dis-charging the ash. To the average layman, this may seem like a simple proposition In the case of small furnaces where opera-

tion is carried on at nominal rating or less, possibly the situation is not so difficult But in these days of large units and continuous operation at high over-ratings, the problem assumes an entirely

new aspect
Boiler operation may be classified in
two groups. There is the station or plant two groups. There is the station or pints whose load changes frequently, sometimes slightly, at other times in violent swings. The bolists may be delivering steam at 100 per cent of rating at one minute, and five or six minutes later he required t deliver 200 or 800 per cent of rating, with an equally sudden drop when the load goes of Ruch experiences are not infre-quent in contral-station practice or in such industries as pulp and paper mills, rolling mills, power stations of coal mines, etc

en there is the station whose le fairly constant for an extended period of time Such changes as occur are gradual and can usually be anticipated. There are practically no sudden fluctuations. Instances of this class are found in the case of power companies operating two or more stations, one of which carries the

swing, while the others operate at a uniform rate. Among industrial plants a good example would be a shon englined with machine tools or a spinning or

shop equipped with machine tools or a spinning or weaving mill where production is fairly steady in stations of the first classification, the operators problem is to deliver steam when and in the quantity, that is required by the plant processes. In the case of

that is required to the plant processes. It central stations supplying light to the community and power to the traction lines, a sudden storm for example, means an instant increase in both the lighting and power load. This increase must be met and carried by the bollers. In the industrial field the sudden call for steam for process purposes, as for example vul-canizing in the rubber industry, means an constring in the rubber inquistry, means an equally sudden peak which the bollers must take. The operator's problem in such cases is, as has already been stated, to deliver the steam. To accomplish that he must have an equipment that is highly dearble.

The elements which make for flexibility are the reserve capacity of the stoker and the ability to clean the fire quickly easily and thoroughly and that the cleaning period should be variable at the will of the operator The reserve capacity of the underfeed stoker is so well known as to call for little additional comment in this discussion Suffice it to say that the mul-tiple-retort stoker with its deep fuel bed provides in the greatest degree the first neumtial element

The power dump is without exception the most satisfactory method of cleaning fires where conditions exist such as have been outlined. It gives the operator abso-lute control over his fire. He can, i necessary, increase the rate of coal feed to meet almost any contingency that may arise Every operator knows that the question of capacity is largely one of the amount of grate area that can be in-stalled under the boiler Temporary operation of 500 or 600 per cent of rating

operation of 500 or 600 per cent of rating is not beyond the point of possibility, provided the boiler can be stoked up to that point. But it would probably be unecconsulted from a good many points of view because no meldom required. The same output, however, can be temporarily at-

tained with a much smaller stoker if the operator feeds the coal in at a high rate, burning off the volatile and discharging a large proportion of the coke. Naturally

this would be very wasteful operation, but when the operator is confronted with the necessity of delivering a certain amount of steam or facing a shutdown, probably it would be the less wasteful course to pursue. ably it would be the less wastern core. A capable operator of course, this is an extreme case. A capable operator seldom gets caught in a jam which would require

Stoker in a Philadelphia power plant fitted with two-roll retary ash discharger

eration of that character. But he frequently finds operation of that character lut he frequently made himself under the necessity of increasing his steam delivery 70 to 100 per cent or more without warning. Under such circumstances he must put more coal through the stokes even though by doing so, he may lose a evaluativable amount of unbrund carbon

As has been said, the power dump is probably the



Cross section of mechanical stoker equipped with power dump for ask arrows show the direction of air circulation

most effective method of cleaning fires to accomplish his purpose. It provides a variable rate of anh dis-charge that functions at the will of the operator. It requires the minimum amount of time to drop the dump plats, so that the accumulation thereon may full into the sub-pit, and return the plate to its normal running position. A glame at the accompanying drawing

will show why it is easily possible to perform this operation in less than haif a minute. It is especially noteworthy that it as each operation with the power dump, there is practically so interruption to steasing as the result of the dumptag periods. For the secret will be secret to the district of the secret will be secret. It is exceeded the secret will be secret. It is the secret will be secret. It is the secret will be secret. It is the secret will be secret. The secret will be secret. It is the secret will be secret. The secret will be secret. The secret will be secret. It is the secret will be secret. The secret will be secret. The secret works the secret will be secret. The secret works, by means of it forms—in other words, by means of the secret will be secret. The most practical and satisfactory of the secret will be secret will be secret will be secret will be secret.

The most practical and antifactory de-vice for secondipibling this result is the rotary and discharge which has been to recommend to the control of the con-ciliance of the control of the con-ciliance of the control of the con-priment's actuage place for and if a spriment's actuage place for and if a pit would probably answer the purpose. It is extraonly difficult to handle hot ash. After the sail has become cool, it has been as the control of the con-trol of the control of the con-trol of the control of the con-trol of t

The san pocket serves as a space in which ash may be treated or conditioned for discharging. The conditioning of the ash involves the final burning out of any combustible which it may contain after it leaves the stoker proper, and the cooling of the refuse

the cooling of the reruse To provide for this the ash pocket is divided hori-sontally into two sections. The upper section is finalled by a grate somewhat similar to the extension grate of the stoker itself. This is provided with ports through

which air may be admitted in any desired quantity The combustible which remains in the ash after it reaches the pocket continues to burn while in this section and this results in reducing to a minimum the combustible in the final residue and, therefore, in increased combustion efficiency

The lower portion of the pocket in financed by cast from crusher plates. These provide a surface against which the clinker can be crushed. In all double-set arrangements of the stoker there are crusher plates on each side of the pocket crusher plates on each side of the pocase. This is also true of single set arrangments where we crusher rolls are provided. When only one crusher roll are provided, the crusher plate is on the stoker side of the pocket and the bridge wall side is lined with a rigid cast-drup plate.

The crusher plate is movable so that the gup between the plate and the roll may be adjusted to any desired width. This provides for crushing the clinker to any size suitable for easy handling by any sate situations for early annuing by any and disposal system It also permits a certain degree of variation in the rate of sand discharge although this is a secundary function. Finally, it provides a means whereby the ash pocket may be empited when the stoker is off the line for cleaning

when the stoker is of the ane for cleaning or overhauling

The crusher rolls are the operating ele-ment of this system of ash discharge They consist of cast-iron shells mounted

They consist of contines shalls mounted as a restel start which has a square cross section. The shells are built up in section. The shells are built up in section. The shells are built up in section that the shell have a triangular cross section which is every devalue and are made removable best is such as the provides the macinum crushing force with the least strain on the rolls or nechasism. The rolls may be operated by the stoker drive or independently as desired. In either case provision is made for varying the speed of the rolls misospaciently

Ventilating an Existing Tunnel

Vestiming an Evising Tunnel

On great has been the increase in motor vehicle traffic

In American cities that those which have street
unnels are finding in many intensors that a new and
serious problem has been created. The exhaust fumes
from moder cases are not interpretatify the occasion of
recommendation of the contract of the contract
serious discountors when wind and weather conditions
are such as to cause the fumes to accumptate. But are such as to cause the fumes to accumulate. But far more serious is the accumulation of motor fumes in traffic tunnels. These bores were originally con-In traffic tunnels. These bores were originally con-structed when automobiles were few or wholly un-movers. With the advent of the gasoline engine and the second of the second of the second of the which is some causes have second traps for funner which is some causes have actually endangered the lives of persons passing through these bores. So sections has the problem become in Los Angeles that it has been necessary to shik two perpendicular ventilating shafts from the top of the hill through which the city's most

used tunnel passes, so that by means of electhat by means of elec-tric fans the foul air in the underground pas-asgeway can be drawn off. By this means the air is changed entirely every few minutes. One of these shafts is 42 inches in diameter and the other one approprithe other one approxi-

mately 18 inches.

The problem of how to dig or drill these ventilating shafts proved an unusual one when the city engineers stort. ed out to find a concern that would undertake the contract The task was different from the ordinary run of drilling or digging jobs and the authorities were somewhat at loss to find men competent to undertake the work. The most practical way seemed to be to drill the hole from the top of the hill to the roof of the tunnel with some kind of well-drillng apparatus, muking the bore as large as pos-sible. Accordingly a driller of oil wells was hired who drilled the smaller of the two holes smaner of the two holes already mentioned at what was conceded a reasonable figure Be-fore he had finished his tusk, however, the work attracted the attention of a man who own and operated a manhole digging machine His ipment was entirely different in character and by means of a ro-tary digger he was able to sink a 42-in

to sink a 42-inch sharf at an operate inhor than that with which the driller could sink an 18-inch sharf has corolingly in the second end was accordingly as outland for the second end was so that the second end was the second end was seen as the second end was seen as the second end was seen as the second end with the second end with the second end with the second end will be seen as tittle lower than that charged by the well driller. Under all the circumstances and in view of the unusual character of the undertaking the city fet! that both nice had earned where the second end is the second end to t

their money The improvem their money
The improvement in the way of two wata with electrically operated fram has proven highly suifactory to
a first of a mine of the proven highly suifactory as
a first of a mile in length. In one filled at all times
with clean, wholesome air. Formerly when these was
tittes wind and traffic was beeny the bore contained
such dieses fames that predestrians found it almost impossible to make their way from and to end.

The Use of Paper in Gardening

WHILE the use of paper for many useful purposes.
Wha gardening, raising flowers and vegetables, may
not be new, nevertheless the advantages, which may
be gained by such practice, are not generally known.

Most people know that paper is a good heat insulator, Most people know that paper 18 n good heat menuator, that is, it is a very poor conductor of heat. Hence, when an object is enveloped in pure 1 is inherent heat is prevented from being ruptify discipated and at the same time the cold or hot all, surrounding the object, is prevented from coming in contast with it and either detracting from or enhancing the heat contained in the body

It is this property of paper that makes it so useful in gardening Furthermore, while ordinary paper is non-transparent and non-translucent when the paper non-transparent and non-transitions, when the paper is silled, it will allow light to pass through it, and at the same time it will be effectively unterproofed. This fact is also of importance in rendering paper applicable for many purposes about the garden and the green-

Actual practical experience has shown that it is possible to obtain effective protection for young seed-lings and tender plants against the inclement weather of winter and early spring by the use of paper Inhouses during the cold winter months. When the seed nouses curing the cold winter meatles. Went the seculings first send up their shoots above the ground, it is often necessary to shade them from direct smillight in this connection it has been found that the diffused light which penetrates through olied paper is particularly well suited to them, and the shades, which must be erected when glass frames are used, are necessary in this case.

necessary in this case.
Old newspapers have been put to many purposes.
They sometimes serve to protect the person against
Cold in lieu of an overout. The same property, which
renders them useful for this utilitation purpose, makes
them a very effective protection against cold for tender
plants. In the carly spring, when frest may still appear
on the ground over night, it is a wise gardner who covers up his plants with newspapers as the evening covers up in injunts with newspapers as the evening sets in and does not remove them again until all the frost has disappeared the next morning. If this is done regularly and conscientiously, no fire heat at all is required, thus simplifying matters and saving money

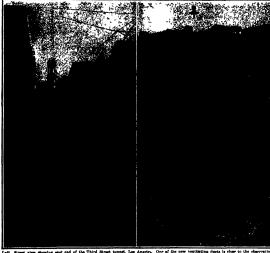
It may be mentioned that when newspapers are used as protection against frost, it some-times happens that one forgets to use them s certain day and the next morning the plants are frozen Heroic means must then be taken to bring them to life again. The best them with Ice cold water before the sun is up and to protect them against the sun s rays with paper covering for some time thereafter The remedy is drastic but sound

An instance is cited of a large hot house full of cinerarias. which were completely from over a certain frosty apparatus going out of order The plants were quite black and apparently ruined, but were brought back again without any ill effects by means of the above treatment

"Only a Little Tric-kle-Let It Run" THOSE best qualified to express an interest in waste of water are those who have the bills to pay It is in communities where wa-ter is not metered that waste is most apt to be ignored, but in the long run the waster pays the erage person to visualbe the amount of waste that can result from leaving ting

toon, Ill, maker of water works equipment has issued a pocket piece resembling a twenty dollar gold piece. This will assure its attention at the start. Of three tiny holes which are bored through it, the largest is only one-eighth of an inch in diameter, yet the pocket-piece hears the legend that in a day of 24 hours, 3800 gailons of water would be wasted from an opening of gallons of water would be wasted from an opening of this size. Another hole which will not permit, the insertion of a penell lead is started to be the potential waster of 900 gallons per day, while a third hole just large enough to receive a pin is nevertheless large enough to permit the flow of 180 gallons or over 3½ barrels. This corresponds to about 140 cubic feet per

The figures given are for a head of 40 pounds ligher pressures would increase the waste, though not in direct proportion to their values. The next time you see a tiny leak, remember that it is capable of making a larger dent in the purse than appearances would indicate, and do not be surprised if a rigid inspecti of plumbing is carried out at times when a water fa ine is a possibility



Left Street view showing must end of the Third Street tunnel, Los Angeles. One of the new ventilating ducts is close to the observation tower Right Sinking the 42-inch ventilating shaft, 90 feet deep, with the use of a manhole digger Los Angeles' street tunnel, designed in meterless days, has had to have ventilating shafts added to take care of the exhaust gases from automotive traffic

stead of employing expensive ghose for the windows of frames and greenbousses, olici paper may be used with just as good resoults and in fact, if taken cure of as conscientionally as glass, they will last just as long. Of course, the cost is very much less. It must be mentioned that such olded paper lights may be ex-

posed to the weather as much as possible and still possess long life Another saving is in the construction

of the frames, which need not be nearly as beavy as when glass is used.

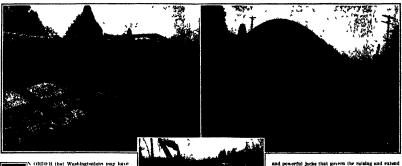
The use of paper for this purpose is not in any way universal, but it is due simply to ignorance of the effectiveness and the cheapness of the material In France, where intensive cultivation of vegetables is France, where intendive cultivation of vegetables in curried out to a far greatest deeper than in this country, the uties of paper for making the visibility and the state of paper for making the visibility and paper in the part of the

ers long life

More Water for Washington

The Great New Conduit that Will Double the Capital City's Supply

By George H Dacy



Office that wantingoman may have harty f water to drink—the City of Presidents has been menaced by a portonding water familine for several year—tacle Sam is building a large new water conduit that clean of the District of Columbia where Mat I the bundary of the District of Columbia where an own mod if liter plant will be treatible! Away back in 18 8 the first columbia to the treatible of the second in 18 the first columbia to the columbia

an to are w and attain the dimensions of a w while of that I he population in reconsidered very marked is With the dwint of the usuade of more thirsty coasumers the water supply began to be had quant. Now with a p-julatin a f more than 48 000 permanent read dates with until of households of transletts through datis with until thousands of transferate throughts int the bederal capital dails the 24 hour water supply of 100 000 000 gail as is insufficient. And peculiarly nearly the consumers use more water during the win to that duting the draughty hot and mangay months to than duting the drughtly hot and miggy meantas of summer ir bubly due to the fact that many let their water run constantly to keep the pipes from freezing a noith na are such in our Capital City that sanilary drinking, water has to be used in washing the streets

sprinkling lewns and extinguishing fires

A new concrete conduit is now under cowhich parallels the route of the old conduit e usin ing evidence of the resolutions that have been a usin his, evidence of the revolutions that have been wheth a new, thereing and construction operations is to be hed from no entired the systems of building evidence and the systems of building evidence and the system of the systems of the syste

the War of Seconsion
The concette pipeline now under construction is 10
feet high and 10 feet wide beins, of horseshoe form
Whereas the conduction on its week has a cross section of
proximately one-quarter larger. When completed the
win pipelines will have a combined carrying capacity
that will practically double the extends Washington
water supply. There will be the additional bareful

Some details of the work on Washington's new

feature that potentially if either of the conduits n repair such a one can be temporarily put out of com-mission without putting the District of Columbia on

The concrete conduit is being laid in 80-foot sections the facilities being such that one of these sections of concrete can be prepared daily. Extraordinary metal forms are used which take the doubt and danger out forms are used which take ine doubt and manger out of concrete work and which immeasurably expedite the work. The excavation is accumplished by the use of powerful steem shorels—mechanical diggers that have elimin ted the ardious hand toll from treach work. elimin ted the ardnous hand toil from treach work.
After the treach is properly prepared the concrete base
of the conduit is laid in place—this foundation is 10
inches thick the wall of the couldir jub pelag smallest
at the base point. The walls are 84 inches thick at
the base point. The walls are 84 inches thick at
their base point and 12 inches thick at crown of the
arch. In the neighborhood of 100,000 cable, parts of
concrete will be used to the building of the inne-mile
concrete will be used to the building of the inne-mile

concrete will be used in the outlong or the anisotropic conduct the mixture being a cose, two, four combination. Two lines of temporary steel trackways are installed when this concrete broadstries is set theoretical brainty tracks provide transportation facilities for a seribe of small care that are equipped with translocking

and powerful jocks that govern he rulaing and extend ing or lowering and collapsing of the interior under forms that hold the concrete in place. Briefly these metallic forms, which strikingly simplify concrete on struction of this characts, can be moved about on the contraction of the characts, can be moved about on the interior forms they are lowered by means of the jecks and loosened by use of the turn buckles. Cables are adjusted properly and hitched to a gassiline tractor that runs along the roudway above freed, and each sat a site of line to hault he set the trench, and each as a site of line to hault he set of the trench, and each as a site of line to hault he set of the ready of the set of the set of the contract of the set of the contract of the set of the conduct and provides passageway for the exterior forms which are bung on a special traveler that will coavey then to the next point of contraction and wides the exterior nexts forms after the concrete and wides the exterior nexts forms after the concrete has been poured and set sufficiently for such operations.

and wides the exterior mean norms after the construc-has been poured and set sufficiently for such operations. Altogether, the national engineers are using three sets

and widen the exterior metal forms after the concrete has been powerful and at sufficiently for each operations about the second of these manmoth metal forms which cover a stretch of these manmoth metal forms which cover a stretch of the result of the proper the concrete in the last form of the irrital first so that by the time they are placing of the irrital first so that by the time they are placing to the control of the property of the control of the control of the control of the control of the irrital moved to a point of the treator and being the control of the cont

Protecting a Beach From Eresion by Ice 17438 assent to which lost notion and labor can be made by plasman in shown by a piece of construction which the writer did with his own hands unaided in the days limit. No job constrained in the construction of a conserve see wall to protect the baset in front of a conserve see wall to protect the baset in front of a conserve see wall to protect the baset in front of a conserve see wall to protect the baset in front of a conserve see when the protect is the conserve that the protect is the conserve that the

his home in Northern stichigan from the rawages of the yearly spring ice flow.

The wall was of trapesoidal section, 8 feet 6 inches thick at the bottom, 12 inches thick at the top and 3 feet 6 inches high. The lower 18 inches of height was under water. The essential points wherein labor was

under water. The easmital points wherein lator was ared say his of a sizele section of nun-cultipatible form, which was set and filled one day, not moved about an ellipse about a ellipse about a ellipse about a ellipse was necessarily and rebuilding was necessarily to that so weeking and rebuilding was necessarily to consent the ellipse about a ellipse allowed by the closest it and pulsed about plus and into its new positions.

ton

2. No gravel was mived with the mortar Joy stones graded in size from that of a hens egg to that of a man's head were placed in the form. A very liquid mortar of said, essent, and sufficient line to frauer and discount into the stones, where it flowed down niled nit the interactives and bound the whole together into a solid mass. Thus about 00 per cent of mixing labor was saved, bestfer making it possible to substitute the relatively easy been inhaling for already mixing and through directly lato the mortar box, rendy for mixing attention and directly lato the mortar box, rendy for mixing, without any further handling

throws directly into the mortar box, ready for mixing, without any further handling
4 The mortar box was supported directly over the wall, so that by simply removing a movuble end, the mortar run by gravity into

the forms.

The wall was poured in sections and only half of the height poured at our time, the upper half of one section being soured at the same time with the lower half of the following section. Thus 7 feet thes of wall was completed each work

ing day In the morning a row of light sheet piling was driven in front of a section of wall to keep the waves from dashing into the work The sand was then excavated to a depth of about 18 inches below water to a depth of about 18 inches below with lines, and a layer of old plank laid on the bottom and weighted down with rocks. The form for the lower part of the wall was then moved ahead placed on the plank floor and weighted into place. The form for the upper section of wall was moved ahead on to the lower section ared the preceding day

In the afternoon, both forms were filled in the atternoon, both forms were nined with rocks placed by hand, and the grout sufficient to fill the voids between the rocks was nived and poured Usually two batches would do this. There was usually a little time remaining in the afternoon, which was given to fluishing the surface and painting with a

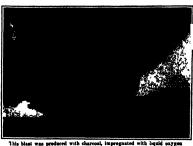
raterproof cement paint

The wall was also tied together longitudinally by
everal second hand light weight railroad rails which

were pu comers of an abor earby, and which were faced by hand in the forms locating the around them Four of these were bedded in the wall for its full length. The space behind the wall was after-ward filled solid with sand. and boulders hauled in by a local farmer

The prevailing wind is diagonally toward the beach and there is a con-tinual drift of sand along the beach by reason of this diagonal motion of the waves After building the wall the writer conceived the idea of plucing obstruc-tions in the way of this sand drift to hold it and build a beach outside the wall mak-He drove a few lines of sheet piling just outside the wall and transverse to

it, projecting a few inches above water. The result was that in a couple of weeks a strip of beach from six to eight feet wide was made outside the wall. The first season's use has shown this to be a thoroughly satisfactory protection the slopin, front face of the wall deflecting the ice upward and breaking it up as



Liquid Ovygen as an Explosive

I (QUID oxygen is produced comme really by the frac-tional distillation of liquid air. The latter sub-stance just like the ordinary atmospheric air, contains. 21 per can of oxygen and 79 per cent of nitrogen. The

21 per chi of oxyge a find 30 per cent or introgen. The introgen is more volatile, and exporter more rapidly than the oxygen. Taking advantage of this, apparatus has been designed for exporting all the introgen out and tearing the liquid oxygen. This is chicage than condensing free. over a major than condensing free over the constant of the control of getting the free over in the gussous state free from impurity

Among the interesting possible applica tions of liquid oxygen one is as an explo ive in connection with charcoal charcoal at zero Centigrade will absorb 19 times its volume of gaseous oxygen, at the temperature of liquid oxygen it will take up 230 volumes instead of this mete 18 The charcoal thus impregnated burns with such extreme speed as to give

burns with such extreme speed as to give violent detonation.

The explosion pictured was produced by liquid-raygen impregnated charcoal, using home made methods exclusively. The chircoal was finity powdered and placed in a linen sack 3½ inches in diameter and 15 inches long to the end of which was featured a famulte fine of which was fustened a dynamite fuse

without an perusedor cap A hole was without an perusedor cap A hole was prepared under 14-inch stump and after subnerging the suck of charcoal in liquid oxygen for about two minutes it was thered hastily in the hole tamped and the fine lighted. The explosion was similar to that the free Highted of dynamic. The stump was entirely removed and the roots so shattered that it would require very little additional work to remove them while it seems that after using dynamite the stumps are often merely split ut removing them

It is suggested that liquid oxygen can be made at a price to compete with other commercial explosives. Other substances such as cork, suit sawdust, etc. may be used in place of charcoal

Weathering Tests of Stone

WEATIN RING tests consisting of freezing and thawing of the specimens until disintegration oc-VV thawing of the specimens until distinguishments occur are in progress at the Bureau of Stundards on 22 samples of limitation and 23 of sandature. Some of 22 samples of the state and 23 of sandature. Some of contributing any appreciable amount of decay while the power grades of this material were disintegrated by 100 free sign? Tests on the sandatones have only recently bent started and so far the samples have only recently bent started and so far the samples have subject to the sample of the sample

anoman no great amount or occay.

A number of limestone and sandatons specimens are also being tested by soaking in a 15 per cent solution of sodium chloride and drying afterwards to obtain a crystallization of the sait in the pores of the stone crystalization of the sain in the policy of the This produces an action similar to that of frost but more severe. It has been found that limestones which stood up under several hundred of the freerings were more severe it has been cound that ilmestones when strond up under several hundred of the free/ings were disintegrated by less than 100 cristallizations in the sail test. However the actual disintegration seems to be similar to that produced by the action of frost and homes it is believed that there is a possibility of using this method as an accelerated weathering test



The owner of this bungalow has temperarily checkmated the spring flow of ice in the lake, which threatened to scour his property off the map

Laying Rails 420 Feet Long

WHITE canned in relaying track the street rail-way line in Washington, b. C. recently adopted an unusual nethod of welding and installing its rails without interruption to traffic. The rails to be installais were intel sing the side of its stret parallel to the track, welded together during the day line by me ans of thermit welding into continuous lengths of several

rails, then transported with the aid of a large gang of men equipped with rail tong, close to the edge of tang, close to the edge of the track and installed dur-ing the early inactive hours of the morning. In one case a pair of rail lengths each consisted of seven rails, making continuous lengths of 420 feet as shown in an

Aluminum Scenery

WOOD has become very Opera House aluminum has been substituted for wood for the frames for seenery Scenary thus mounted is much easier to handle and much caster to handle and the fire risk is ininimized. The sessery can be attached to both sides, and even dec-orations can be painted on the wooden frames. No acoustic difficulties have been experienced



Welding ralls before laying, and plucing them in 420-feet lengths after traffic



Left Army ants marching in single file note the great killing mandbles on the central figure (magnified five times) Right Army ant bringing home as booty the leg of an insect visitin. This straighting of the burden is observatoristic

The Army Ants of British Guiana

Jungle Insects that Have Learned the Importance of Force of Numbers and Discipline

By Paul Griswold Howes

Assistant Curator of the Bruce Memorial Museum, Greenwich, Conn.

PON the ever moist floor of the great din jungle that covers nearly all of British Guiana, live the gypsy tribes of armanis. These tribes consist of astounding numbers of individuals, divided into various sizes, and upon whom full various has been expected enemy of the groups. These

numbers of individuals, divided into various sizes, and upon whom full various burdens in the general economy of the groups. They make no permanent nests at all, but instead roun the forests, carrying the entire where-with-all of their social existence about with them

existence about with them
how, was traveling rapidly across an open space in
front of the camp. The line of march was not over
whe facility in which, but if extended across the elear
two the close is with, but if extended across the elear
whe facility is with, but if extended across the elear
two the close is with the control of the control of the control
portal. This same may cover for many hours without
halt, or even the slightest let up, and there must have
viduals in the line. Third evelutation was an old
foundation on the edge of the elearing, and thus this
the insects poster all day long. The intra curried
the insects poster all day long. The intra curried
the insects poster all day long. The intra curried
the insects poster all day long. The intra curried
the insects poster all day long. The intra curried
to the control of the control of the control
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The ants stayed here all night but by morning they had gone on into the forces. This army was simply moving. The command of instinct had decreed a march only. So handing was to take place; and so the whole great tribs moved forward in a thin line without a glance from side to side. Such is the marvelous distipline of instinct.

When the command says hunt, everything changes. The millier attitude of the multitude change instantly. Every ant becomes a ferectons deman, a fiery reckless and mercless creature that will nature lamping and give list life if the necessity arises. They launch themselves into the forest in great networks, that gradually enclose certain areas, and every living thing that is work as well as many of the stronger ones, fall before

If one is traveling through the forest, a certain sign of presence of a hunting army, is the calling and chirping of a number of different san-throughes, and other birds that have banded together into a flock. These birds follow the armies, parily because of the insect life that is situred skep panile, and parily because of the

tif bits of refuse that the army leaves, in the form of legs and other parts that have been torn from the

When such a flock is hard, a few minuter hunt will reveal the entry at its deadly such, while at other times one will know well enough that the lines have been crossed by the severe and thousehigh biting of one's less, followed by a painful stinging that causes one to take to the trull in haste to resource the energetic most. Once they blie latto the skin their jaws become quite injuly boled so that it is often necessary to pail them the still the still the still the still the still the promising them are the still the still the still the promising them are the still the still the still the promising them are the still the still the severe the header from the bodies.

During these drives, every insect is frightened from cover and instantly pounced upon by as many individuals as happen to be nor. They artanily tear the victim limb from limb and it is then taken to the nest for that day, in many fragments. Almost as soon as an ant law secured a portion of food, it cases its wild



Front view, greatly enlarged, of a warrior ant, showing the powerful nippers

blood thirsty actions and goes to the rear, its duty accomplished.

If a large insect such as a grasshopper or a big

If a large insect such as a grasshopper or a cig juncle roach is thrown sucong the ants, it will event unily be vanquished by sheer weight of numbers. As it lands among the warriors, one or two will lock their jaws upon its tega wids lightning rapidity. The suffers will now hop or fig in agens, but the instant it lands again, several more gate will grab its appendings. The procedure soon weights the victim to the ground par-

procedure soon weights the victim to the ground parmanently, where it is torm to shreds without delay Ants returning to the rear often assist one another in various ways. As it is unally the custom to straddle one's booty on the homeward journey, the ant is frequently arently hampered by the size of the cut. Again a long caterpillar may be the victim, one that has been left intext, ording to its allular resistance, and thus becure or great hurden. In three, and similar cause, antawere observed to come to the assistance of their sisters. They would help drag the users ledge of hold the abdouses of a sister up out of the way, and in one case two anta-were seen to straddle a caterpillar and thus carry it along on their tail legs, like so many laborers carryling a railroad rail or a by [6].

Birds and animals are not immune to the attacking anis, especially young once. In fact any animal would soon successibly to their myrind bites if there were no avenue for escape One realizes how great are their numbers when a distinct and strange rustling murmurrencies the ear, due to the thranking about of counties

bodies.

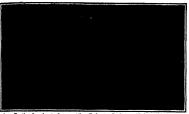
Some creatures have learned to escape. Thus the smaller species of spiders, leap from their perches at the approach of the ants and remain asfely suspended upon a silken thread until the danger is past. On the other hand very large snakes are sometimes killed and devoured, before they can get beyond the lines of the

The entire tribe does not take part in the drive for cool. A large number of workers remain at the tem power next to care for the eggs and young while the warrious are sway, and warms of workers also cluster the estructe as that it looks like a brown thery regretional tributes and the state of the state of the luminer return, they are carefully breaked and consider by the workers, and their booty is dropped and careful passage to the interior is lined thickly with a network of anis to him every individual mate, The same and of anis to him every individual mate pass along a living

of ante so that every individual must pass along a living sensor for pin erirace.

In speace to grain erirace, the cost of many other fourth American countries and also the Bovianders and white people, have learned to respect the army ants because of their house cleaning proposalities. Every the solid woodes ones of civilization, are more or less infected with very large roaches, and other insects and has being transition, with choose only to obtain the about mage transition, with choose only to obtain the human being, but the army ants are fond of all of them. They come not infrequently, in tremession armies, to the abodes of max, and in the course of a before the chance change in the course of a before the chance of the course of a before the chance of the course of a before the chance of the chance of the course of a before the chance of the

before
In these great tribes there is but a single Queen
Der sole duty is egsplering after the colony is onetime and the second of the second of the colony is oneduty in the second of the second



An effective barrier to keep cattle off the tracks is provided by this uneven

Scaring the Cattle Off the Tracks

Secring the Cattle UII the Tracks
MCDII interest is attached to the recent development
of the Company of the Co

As animals approach the guard they are als

by the irregular and strange appearance presented by the alternating conical rollers and many do not come my nearer. But if they become holder and advance to the guard so as to place one foot upon it, the lers revolve underment their foot, and most animals rollers revolve undermeath their feet, and most animals still immediately leave. Where the animal puts one foot upon the rollers and, still unalarmed, tries to advance with another foot, bis weight rotates the rollers under his foot and he will find it impossible

A Clever Job of Continuous Packing

A N interesting apparatus for the mechanical packing of tea is to be seen in a San Francisco factory

An overhead track system supports a unit of six travel in the six frame in the shifted so as to bring any bia lirectly above the chute, D, that leads to the weighing scales. In this was any number of cans can be packed with any desired it pao of tea, and a shift made as often

otete.

is losing the last of its con tents to the packing ms chine. In this way tea can be kept running continu ously, with never a failure of the supply of any brand and never an empty bin We have seen numerous appli-cations of the idea of continuous packing but none that seemed more generally effective than this one.

position in a few seconds The bins themselves are

and can be filled from above

The Wind-Power Automobile

A automobile whose operating expense includes no provision for power might seem as though it should go in the class with the mysterious green fluid that makes gasoline out of water—it certainly sounds like a craxy dream or an outright fraud. Nevertheless Mr. A. I Root, the dean of the American bee industry

and publisher of Olevinings in Bre Culture has such an automobile at his winter home in Piordin The answer is a pair of busy windmills. The car is an electric. The mills are two in number, 16-foot wheels on 00-foot towers. Instead of having a counterwheels on O-foot towers. Instead of having a counter-shirt or a set of genra for multiply the speed of the wheel to the necessary dynamo speed, the dynamo is sheel and connected by means of a best raming clear around the circumference of the wheel and then directly to the gene rate shaft. To provide for varying weather to the gene rate shaft. To provide for varying weather the general control of the connected by the control fact which is not to the control of the weather conditions to which it is exposed. Whether the conditions to which it is exposed. Whether the conditions to which it is exposed. Whether states is the unit in parameters of the control of the con-trol of the control of the control of the control of the states, is the unit in parameters of in North Batotra stated, but the mill is manufactured in North Dakota and widely used there for farm lighting, which sug gests that bilizzards are a mere incident in its life. The gests that bilizards are a mere incident in its life. The generator is mounted on a revolving platform and goes with the wheel as the wind shifts. The cost of a single mill with switchboard and all other apparatus but stituout a battery, was given, at the time of writing, as \$1500. We think it probable that today it would be somewhat less, but whether the reduction would be a material one we cannot say with any degree of cer-

It is a familiar experience with users of the gasoline It is a familiar experience with users of the gusoline automobile that it is not an economical means of pro-viding small units of transportation. Many cars are employed for little more than the dulti drive to the station and back, a run of at the most five to six miles. station and used, a run or at the most rive to an misse. Cars that develop 20 or even 25 indices per gallon on longer runs are barely warmed up to their work at the end of the run to the station, and give this sort of service at excessive their cost. The electric is an ideal vibility for over of this character, if the work of charg-

whiche for work of this character, if the work of charg-ing can be done without pajing an exceedite profit to someone For charging from a windmill, as light a machine as possible should be secured, with a gmall buttery that does not make much if any more than 35. nuch if any more than 25, miles on one charge. A light battery, charged little and often and kept full, is the thing for this usage. The automobile is to be left in the garage and connected with the dynamo all the with the dynamo all the time when it is not actually on the road A cutout, sin-ilar to the one between bat tery and generator on the ordinary gasoline cars, must be provided in order to in sure that at low speeds or when there is no wind at all the battery shall not dis-charge through the dyname This cutout is operated mag natically, and breaks the cir-cuit leading to the battery whenever the dynamo is not



This windmill and another like it drive the family car about six miles per day, and light the house in

turning over at a predetermined rate Contrary to what the non-electrician might expect, such cut-outs are neither complicated, nor likely to get out of order Mr Root, from his two windmills, keeps his car fully charged for its regular duty of five or at miles per day, and in addition lights his house. He finds that a day, and in addition lights his house. He finds that is stagle withouth operates rather fittill), but that with two going at once, even when they stand close together, the wind is sufficiently experience to house that one other is not. Aviators will confirm the inference that other is not. Aviators will confirm the inference that considerable variations in air movement are met be-tween points only a couple of hundred feet apart. With his two mills connected up. Mr. Root finds that the charging curve is entirely smooth enough for all purposes.

A Lilliputian Piano

A MONG the attractions of one of London's sumus-ment places is the miniature grand plane illus-trated. Exact dimensions are not given us, but the finger of the user affords a very good approximate scale by which the actual size of this tim, musical instrument may be estimated. In spite of its Tom Thumb appearance, this plane can be played in the usual way by one with sufficient control of his fingers. The extent to which the editorial digits find the wrong key on the editorial typewriter make us wonder what kind of a successful 15 pewriter minke us wonder what kind of a finger this would be, but that does not alter the fast that the plano can be played, just like any other plano by anyone able to play it. Perhaps, as in the case of some of the string instruments, one picks at this key board with an artificial flance-end

is the orders of the day require, or special blends can be made with a minimum of trouble. The overhead sys-em is operated by a drum-wound cable, and any bin can

Movable bins on an overhead track add flexibility to this ton-packing outfit



Speaking of buby grands—here is one from a London amusement hall

What Happens When the Tire Hits the Road

Studying the Impacts from Pot-Holes and Obstructions, with Different Types of Tires

leave histownys? The road on gine er, the road on right on dishtegrating, wow the United States Hurston of touch is attacking the question of the road surface, road structure answer The investigation deals with road surface, road structure insurface drainings, and traffic of reransient vatice are the indicates are the formation of the road surface of the road surface of the road surface of the road surface of the road structure are the formation of the road surface of the road of the roa

the road

Most algorithmics of the findings is
that it is not chiefly the dead wright
of motor trucks that destroys the
highway. If a truck airtices an obstruction on the road, or if it runs
into and out of a pat hole, the wheel
comes down on the road with a
destruction, crucking the surface
and breaking, the foundation, the foundation,
the foundation, the foundation, the foundation,

This impact can be measured as speed of load per unit of wheel bearing surface, or truck speed of load per unit of wheel bearing surface, or pose design, each log along the highway airfule standing along the highway airfule machine the surface of the surface and freight surface of the surface of the surface of the surface of the surface bearing the surface bearing

on more means can be insected 1100.

In the many can be insected in the results of the study of the problem. A solid litred, five-ton truck, operating at 17½ miles per hour with a flw-ton load, on articling a two-inch obstante delivers is how on the pavement of 2,0000 pounds. The same truck with paeamantic tires, may curry an extra ton of load and under the same circumstances deliver a blow or day 11,000 pounds.

Does this indicate that all trucks ought to be shod with air? By no neuma. Impact varies with the speed and the load carried. Take the coal desire delivering in a business district. The extreme weight of the truck and the load restrict the speed to

and in slide bearing speech as a second of the beary traffic has the same effect. Comparatively little condensity is necessary to protect the road and the true from the fars of impact conduction of the second of

There is a right and proper and exhannel fire for each set of conditions. Knowing the conditions. Knowing the conditions. Knowing the conditions with the condition of the condi

The blow delivered to the read when a two-ton truck, with a two-ton load, runs into a two-inch hole or rut, depends vary largely upon the type of the carried. At lower speeds the difference would be ions, at higher appeals more, in favor of the more abord-abording three

necessarily be prepared for such a difference as the chart shows. To the lalpman, in this cannectus, it may be a constructed to the construction of the construction o

proportionate to the cost of the beter trucking practice.

Coupsing the three types of irrs, it seems eathy senegatible of picot that the presumants has griphed that the presumants has griphed to the three presumants are presented to the presumants and present the presumants of the pres

The Senses of Insects

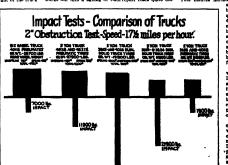
N the instrument of the mint is said in the first in the

sects than in man, yet Dr. McMood found that by smell slosue he could distanguish the three coares of here as well as other components of the hire coares of here as well as other components of the hire. It is probable that each individual bee has its pacular color, but it is the combination of all those that makes up the hire odes and his giferended as the most important and as indeed the reliag power in a colony it is a means of protecting the social life of the bose in the control of the contro

In the control of the second into within. The Interest collimation of the second into within. The Interest hisrariogy and a united defense against stinck. The queen odor constantly informs the workers that their queen in present. Even though side overyrhing to the been in preparating the colony. Thus, by obeying the wortyrhing to the been in preparating the colony. Thus, by obeying the simulity of the hire of the preparating the colony. Thus, by obeying the simulity of the hire of the second of the colony of these could not went as the time of the colony of these could not went as the preparation of the colony of these could not went as the preparation of the colony of these could not went as the colony of these could not went as the colony of the colony.

What, then, are the organs by which insects recognise these odors. The first recognise these odors which insects recognise these odors annul pores scattered or grouped her body sea appendages. A nerveade is each pore, and the open is often protected by a heli? By covering the pores, experiments proud of thest olinicatory function was section we

out the will have a good of the last power will known, and that last power will known, and that last power will known and the power will be the power will b



The United States Bureau of Roads, in addition to the "jumping-off" impacts of our first drawing, has also studied what happens when the moving truck letts an obstruction. The difference here is even greater in favor of the more officient tirges this it was in the drop tend



Mail drepped in this box in the country is collected in the city, to the great expedition of its handling

A Traveling Post-Box

A Traveling Post-Box

Dural free delivery is not the only means of ex

tending the scope of Uncle Sam's service to communities and isolated houses off the main line of

communication. The latest idea for making the main

more metal indrovier the mounting on interarban trol

leys of ordinary mult boxes. At any point along the

line is terms may be posted in these boxes to be removed by the postman when the car reaches a good sized town. This is a long step forward from the condition where the people strung out through the country ure dependent upon the once-dully passing of the mall carrier for their contents with the cuter world

Motor Propulsion for the Legiess

I Highth's a cripple through an attack of infantile paralysis, a member of one of New York's closes families has invented the legiesa automobile which we illustrate Though the user is seen with trousers and families has invested the legions untrovable a hit as the limited to the legions of the limited and and a shows his legs are uncless to him and any means of any any and the semplos among the men the can be entricate controlled with the hands. The conventional properties of the semplos among the conventional but deplayed a touch of invastive gradus in decisioning a motor-driven substitute. It is in fact in ever detail worthy of the designation "autorobble saw only that its dimensions are a bit neaver those of the motor strikes hearer the evide than the car in that it has a single front whose, steered by har rather than by wheel The other controls are for the largue part assembled upon the handles of the bars where they are wastly accombine.

Airplane, or Plain Filwer?

WHILE M Barbot and his nerial filwer an in the public eye seems a good time to put on display another kind of airplane filwer—no actually built of the public eye seems a good time to put on display another kind of airplane filwer—no actually built of the public of the filmer and the filmer an



This sirplane-style body is the intest model in famer diverts

Gas and Oil on the Fly

Case assar USI on the Fry

O'NE of the things that hape the long-distance
record seeker on road or on trik is the stop for
supplies. When a thre splacement with order there
seems no way out but a recent is formance on the
Bodianapolis Speedway demonstrative that trops for gas
are simply a matter of hill. The distance
are simply a matter of hill. The distance
Sixth within—the distance from Nea 3, by to I can knowles for the run was determined in astonic belighter than 3355 milles—the distinct from Non-1 rt to Los Angelies via the William Pean National Old I rails route. All service adds from the tire replace in its was schiered from a second car, which took the to it and kept pace from a second car, which took the to it and kept pace below. Insurant, as the car unit took finding the Durant and the car unit to the distance in 21 minutes over an xxxx per pace it, will be seen that the 50-salie filling apoct propre and a distinct solving from an the part of life differs the preferred and strength of the second pace of the contract of the contrac

The Heating Value of Gas

TECHNOTOKIC Paper to ... I the Bureau of Standards for sale by the Superintendent of Documents, Government Printing Office Washington, D. C. at 25 cents a copy gives the results f laboratory test conducted at the request of the I tille Service Com conducted at the requiset of the 1 silts 'srvice' Oun mission of Maryland on the rivities userlaness of gasses of different heeting values and the correct adjustment of the receiver of changes in the heeting value of the correct and the continuous contracts of the correct was a time when as was used almost exclusively for lighting purposes and in the ordinances regulating gas companies it was usual to require gas having a certainf liminating usuals for recently passing acceptable and the contract of the correct passing acceptable of the



Motor travel for the legions, in a machine that is controlled entirely by hand

has been used more and more for herting purposes and less for lighting or when used for purposes of the manifest for lighting or when used for purposes of thumination, it is almost always berned in a manife burner. This was accompanied it a clause in most regulations from an illustrating in the healting value leads will innove recently it has been found necessary in some causes to reduce the lit (line, power of the gas due to intreased cent and other difficulties of manu

facture. The present paper deals with 1 condition thus brought about the tests having len conducted primar lity to determine whether the c numers in Ratifunces were getting as good gas service with the present stand and of 500 B tu per cubic foot as they obtained with gas of a higher heating whim in 6 mer days. The put or a nigner nesting value in Other days. The tests showed that with proper adjustment of the appli-ances the service should be again; good. The relative cost of the service however under the two conditions was not taken into consideration in this report

Wave-Length Measurements in Arc Spectra (OMPOUNDS of the rare earth elements which are used extensively in the manufacture of gus light mantles and cored earthous for electric area and less extensively in the taxtile and plans industries for their extensively in the textiles and plans industries for their coloring properties, was about the most difficult sains coloring properties, was about the most affected saint larv laboratory of the Dalwerith of Illinon has anc-ceded in preparing some of the members of the rare earth family it a high dispress of parity and has sub-mitted to the Bower of Standards amples of these mitted to the Bower of Standards amples of these original consignment of patients in now completed so-dification frapies of the section of the second of Standard Papies A, 465 has put been issued described the results that have been obtained for the two else-ments gadolisms and dyproximal. Two preceding



Filling a racing car with gas and oil at fifty miles

papers have dealt with yttrium lanthanum and cer-ium and with neodymium and samarium. The spec-troscopic analysis confirms the degree of purity at tained by the chemists in separating the gadolinium and dysprosium salts from the original materials and in addition yields an accurate description of the green vellow and and infrared spectral regions of these elements which have only been covered incompletely

In titofore

The data collected from the observations are compiled in two tables one of which contains about 900 wave lengths in the arc spectrum of gadolinium and the other about 800 wave lengths in the arc spectrum of dispresion. These data are of value chiefly to chemists who are interested in problems of analysis, to astronomers who are concerned with the chemical to astronomers who are concerned with the chosmical composition of the stars and to physiciats in connection with atomic structure. This paper can be obtained from the Superintendent of Decuments Government Printing Office Washington D C at 5 cents a copy

A Novel Instrument for Navigators

A Novel Instrument for Navigators
UNIV. the updated angle calculated illustrated berewith it is claimed that the data necessary for
with a read in meased facility and a weeks position
determined from a single observation. What this is
stumant really do is it so set up in the form of a small
model into various antenancial and a corraphical cirtimes. Whereappears sentil defines and azimuth ser read
off the various activated and the servance of the control of the control
is known alone at the dial and the object position
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In the pit corraphic transversal to exercise and is

In the pit corraphic transversal to exercise and is.

placed by the automatic varieties of the instrument. In the photograph 1 represents the earths axis It is jurnalized to the declination circle B and securely company 7 as to be a few places and the properties of company 7 as to have the object justice—which is of course unknown to be gim with and which gets decremined at 1) as the secting of the ray table parts of the calculator to match the object with a sum of the calculator to match the object with a sum of the calculator to match the object with a sum of the calculator to match the object with a sum of the calculator. and incidentally represents also the ship smeridia correspondence between the model and the visible uni verse with the ship in its center is chalque



A spherical-angle calculator that does much of the navigator's hard work for him



eareful wears rs tight gloves trie cap lamp Some incidents in the life of the coal miner which make for safety or danger

Safeguarding the Miner

Safety-First Cooperation of the Bureau of Mines, the Operators and the Miners

IFN several mining disasters, such as those which followed the last miners sirike, occur, we must be careful not to draw the conclusion that mining accidents draw the concluded that initiag are identically on the fire to see that the present them as a being indeed to prevent them as a matter of the fire them as a constraint of the first them as a constraint of the first them as the first thands the first them as the first them as the first them as the fi

433 lives, whereas in 1020 eight summer accounter-suited in only 01 deaths, and whereas in 1011 implor disasters caused 175 per cent of the total killed at cout mines, in 1620 only 27 per cent of the total deaths from all causes were due to major disasters. Now the reddit for this improvement is due to the preventive work done by the United States Bureau of Mines. We are told by its Acting Director, Mr. II. Foster Bain, that 12 years ago there was no general country wide service for the systematic training of miners in matters relat for the systematic training of inthers in marters resisting to safety a stight beginning only having been made in a few scattered points. There was no such urgent need for training in those days, for so long as the mines were small and the workers intelligent and well rained in routine mining methods, and when the pressure for output had not yet speeded up the industry to its pressure pitch, it sufficed very well for each man to kook after himself and for the bossess and superin-tendants to red; upon improvised methods when major

But when the enormous expansion of coal mining brought about the introduction of new and little trained labor, and when the scale of production was so greatly increased there was a rapid rise in the dangers of mining. The increased output in the mining of today has been obtained from the substantially same number

of miners as ten years ago but the pe sonnel is not nearly so well trained in mining. There was a series of disasters and mine explosions immediately prior to the organisation of the Bureau of Mines and the problem before the Bureau was that of reducing the number and severity of these. To this end the Bureau of Mines sought the cooperation of the State Mine Inspectors, the mine operators, and various other agencies, and while the full various other agencies, and while the full buscuits resulting from preventive and remedial measures cannot be gaged ac-curately by faures only the statistics, as given above, show that greatly beneficial results have been obtained. When the work of obtaining records of the injured at the mines was undertaken

the injured at the inmice was undertaken by the Bureau in 1911, many of the States kept no record of such accidents, and the record shows a small number of injuries reported to the Bureau during the first few years after 1911. The ap-parent increase to injury reports, which

was noticeable from 1911 to 1916, was due in a large measure to State requirements for reporting such in juries and to the rapid enactment of compensation loss by many States during that period Toda, mine oper-



Diagram shows the injuries to various parts of the body in the proportions revealed by the acci-dent statistics

ators in practically all States must report non fatal injuries. The Government now obtains accurate statistics both of deaths and injuries. They show that the number killed per thousand persons has decreased

from 480 in 1911 to 2,00 in 1920. Of late the injury rate has ranged from 224 to 242 per thousand men A. Ver, official sagged in reducing the number of needents and mitigating their effects upon the injured, is the character and extent of the training which is given to those engaged in mining. Minere who receive certificates of free-did retained are instructed and excertificates of first-sid training are instructed and examined in the anotony of the human body, the treatment of hemorrhage, fractures, huma and shock, and cut raining are given those who pass a physical examination, who were breathing apparatus while doing hard labor in atmosphere containing motions and irrespiration gases, and demonstrate their shilly to admit the contraction of the cont one miner in every thousand, but in 1920 the number trained was 8008 which represented nearly ten miners

in every thousand employed.

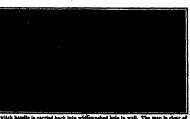
As regards the causes of conl-mine fatalities, it should be noted that nearly built of all deaths at coal mines results from falls of roof and coal, and most of this results from finits of roof and coal, and most of this class of actionts take place at or next the "working face," which is the place where the miners actually unine the coal a few occur elsewhere in the mines, as on a slopes and haulage ways. Many of the falls at the "face" are due to fulture of the miners to take down loose rock or coal or to set props under dangerous places in the roof.

places in the roof.

Mine cars and locumotives underground are responsible for about 17 per cent of all faralities, the victims and the responsible for about 17 per cent of all faralities, the victims are represented in the cars and the cars of t

of gas.

Accidents due to powder and other explatives have caused six per east of all
that mass accidents, increase there and
four per cent have been due to electricity,
and less than five per cent to miscellaneous causes two-per cent to miscellaneous causes two-per cent to miscellaabout 60 per cent have occurred underabout 60 per cent have occurred under-



Switch handle is carried back into widlewashed hele in wall. The man is clear of the handage way and in a safe position

ground, between two and three per cent in shafts and slopes, and slightly less that a shaft and slopes, and slightly less that a shaft and slopes, and slightly less than a shaft and shaft a have been chosen from 200 similar photographs which make up the bulk of the circular Each has beneath it a few explanatory words, and even without these the pictures themselves should con-vey a clear lesson to that large proportion ers of today who cannot read

of the min

English and are, therefore, particularly liable to injury English and are, therefore, particularly lisble to injury. The pictures here represented are selected from those which teach the uniners the principles of self-protection through cars and forethought, and of these there are some 180 in the pumphlet referred to In addition to these three are about a sover of rictures which lituations of present the protection of the protection of the reliase, such as the provision of miscellaneous safety the rilines, such as the provision of miscellaneous safety. the mines, such as the provision of miscellaneous safety devices, emong which may be mentioned an under-ground machine shop, sub-foremen's offices which are kept locked, but with telephone, first aid hox stretcher and skeleton map of mines to placed that they can be reached from the outside, locked explosive magazines, accident bulletin boards, on which an accident which necurs is recorded for a warning to the miners, safety mottoes placed conspicuously at the roof of the mine,

and many similar devices.

Enough has been said to show that this governmental Enough has been said to show that this governmental work is highly humaniturian, that it has already, in a single decade, gone far toward making mining a resamably safe occupation, thus robbing this abso-lutely essential industry of the terror with which it issue too long been associated in the public minds.

A Diminutive Electric Tractor

A Diministry Essective arractor HRR we have two views of a diministry and in-perious tractor which for work performed in pro-portion to its size is certainly remarkable. It was built in Germany in response to the urgent demand for the exercise of all possible economy, particularly in the matter of tran matter of transportation of materials for short dis-tances in large industrial plants. Special effort is being

tances in large industrial plants. Special effort is being unde to replace manual labor by mechanical circus of one kind our another, and it is considered that free and the state of the considered that the case of the considered that the case of tery is in two parts, one carried nerice and the other behind the axie. Above the axie is mounted a little 3.3 horsepower motor, which drives it by means of rears, a chain, and a worm drive. The speed is low, boing only 3.28 feet per second. The operator walks between the shafts, on one of which is mounted a con-troller, and he steers the tructor and keeps it on a troller, and he steers the tructor and keeps it on a level keel so to speak For security, two small rollers are attached, one in front and one behind the tractor with a small clearance above the ground. The ad-vantages of this little vehicle are found in its small



This miner has set a prop under the time lip before starting work with

dimensions, its low weight and the case with which the handled Also it has proved to be very economical, operating at low expense. The ordinary capacity of the battery is 82-kilowatt hours for three hours of discharge but a single charge is sufficient for two days. intermittent operation under the average conditions of work. The average tractive effort is about a quarter of a ton with a maximum effort of one ton. It can hand up to one bundred tons where the load is running on the level upon steel rails on average undulating highways it can haul about ten tons, and running on the banks of a cannil can haul 400 tons of load in bosts or barges. The tractor is 3 15 feet wide, 2 92 feet high and the length over all from the front book to the end of the shaft is 12.78 feet. The total weight is about two tone

Industrial Use of Powdered Coal

Industrial Ose of rowdered Con-DOWD-LFD coal has been decreased by applied and I is commonly used in open-hearth furnaces busheling and puddling furnaces, coalinous-hearing furnaces for blooms and billers furnaces for health greheating, and forging, annually furnaces for malleable iron and steel custings and plates, sheet and pair and anneal steet castings and plates, sheet and pair and anneal-ing furnaces and in pols, gasking plats, or rousting and volatilising, coper-ore roasting and smelting, the zinc industry the gold and silver industry calcining kilns, lime burning refractory materials and also in the fertilizer industry. It is used more than any other first in the cement industry. and has been successfully applied for steam raising Whenever powdered coal has displaced hand firing the

coal consumption has been reduced considerably

By the term powdered coal is meant coal subdivided so that it may be burned in suspansion when mixed with the necessary supply of air and may be conveyed endly by means of a screw conveyor, by compressed air, or suspended in a stream of low pressure air to the furnice

The principal advantages over hand and stoker firing lie in the comparative case of conveying coal to furnace and in the practically complete combustion of the coal, with little excess air, in close contact with the material with little excess air, in close contact with the material to be heated, thus avoiding the convection, radiation and excess-air losses which accompany hand or stoker-fired furnaces placed outside reverberatory and many other furnaces. For this reason the most successful field of use for pulverised coal installations has been for those purposes where they have replaced externally fired furnices. For purposes such as steam raising, where the burning coal can give up he where the burning coal can give up heat directly by radiation to the boller heating surface, there is therefore less opportu-nity for reducing the fuel consumption by burning powdered coal instead of burning coal on a grate, since the losses which may be reduced by substituting powdered firing for hand firing or stoker firing are those only which are due to incom-plete combustion and using excess air These losses, however, are not inconsider-

Certain drawbacks to the use of pow-dered coal are cited by the author of the bulletin Before powdered-coal firing can compete successfully with grate firing it is obvious that the gain due to the sm consumptio n of powdered coul must offset the cost of preparing, conveying and burn

There is a further disselventage with powdered cost. In grate firing the ash is left on the grates and in the ash pit. But with pewdered cost the ash is blown into the furnace. with powdered const the and is nown into the turnace out through the sizek, and with some badly designed furnaces out through openings in the furnaces. It may also form a froublesome slag, and fill up the figes so as to impede the draft

as to impede the draft.

On the whole, powdered-coal plants cannot be said to be clean. There are fairly clean powdered-coal plants, but generally, though not universally a plant using powdered coal is diriter than a grate-fired plant. using powdered coal is driver into a grate-mere part Powdered coal is better adapted for firing stationary water tube bolics than other bolics. With these boli-ers furnases of sufficient six and of the correct shape may be constructed, and the guess pass through no tubes wherein ash may settle to obstruct the draft and shield the heating surface. It has been found difficult to burn powdered coal in iocumolive and cylindrical marine boilers because the combustion space i small to permit the coal to be burned completely

ough men have been killed by explosions ar in powdered coal plants, the causes of such accidents are known and precautions may be taken that they may not recur. Greater precautions are required with some systems than with others. For instance, dangerous fires and explosions have occurred more frequently with the direct low pressure air system of transport than with the indirect screw-conveying or compressed air transport systems, although the indirect transport system has not been entirely free from disasters. system has not been entirely free from disasters. The possibility of a dangerous free or explosion in a well-designed will managed powdered-coal plant is remote and should not influence the prospective user of pow-dered coal against installing it

Mincing Microbes

A MACHINE for killing mirrobes by the simple method of cutting then into bits is described in the British Medical Journal, which states that by this means into ulations against infectious discusses may be made with germs from which the poissons have been made with germs from which the poissons have been removed. Thus if detockated vaccines are used very much larger doses may be administered with increased chance of protection from the disease. Although microbes are so small that 5,000,000 of them in a mass are e and a billion are only the size of the h invision and a minon are only its size of the neuton a plin, this electrically driven machine will cut or smash them. The introbes are suspended in a liquid and forced against 70 small knives at a speed of 60 miles per hour so that 28 000 000 cuts are made in one minute As the germs remain in the machine 20 minutes, they receive 500 000 000 cuts.



A two-ton pony tractor

Tractor hauls loaded cars on the rails

The Maple Sugar Industry

The Tree that Made Vermont Famous, and How its Delectable Juice is Harvested

Br. C. O Ormubes

APLE syrup is a product of the sap of the major traction in the sap of the major traction is a supervisor of the major traction in the same and the same and same and the same reversion of maple sugar, when concentrated to a low degree Maple cakes, maple cream, maple powder and various other pure muple products, consist of maple sugar, variously manipulated, and at various tempera tures. And maple blends are syrups produced by the melting of maple sugar, cane sugar, together with

mediting of maple sugar, cane sugar, together with water ja various proportions.

Maple say is obtained by womaning the maple tree.

Maple say is obtained by womaning the maple tree.

Maple say is sufficient to the say of the say o

Acer searcherum of the botanist. This tree is found only in North America, and its range extends throughout the entire widing of the St. Lawrence River and its tributaries, whose it is the predominating tree, and westerly as far as Minnestr. From Maine it extends southwesterly, well late the Carolinas, thence westerly through Kentucky and Tennessee, well into Arkansas and Missouri, in which states it spreads, in fan shape,

and Missours, in whice source it spreams, in the over an extensive territory.

The Bursau of Forestry is authority for the statement that there are, eastnessed over this entire area, approximately 100,000,000 maple trees. A study of the returns of the last census reveals the fact that of this number but 18,000,000 are utilised in the manufacture. number our 18,000,000 are utilized in the manufacture of maple sugar, and that, even including the sugar equivalent of that part of the product that is marketed in the form of maple syrup, the entire output of maple sugar of the United States falls under 50,000,000 pounds sugar of the United States itsis uncer successfully of this amount 87 per cent is produced in the five states of New York, Vermont, Ohlo, Pennsylvania and Michigan. The total output of Canada is around 30,000,000 pounds annually It is known that but one-third of the available trees in Canada are util ised, while the numbers of non utilised trees in the ised, while the numbers of non utilised trees unsettled regions runs high into the millions,

hairs," and iscuted near the extremities of the spaller roofset. This moditure consides of an extremely weak roofset. This moditure consides of an extremely was freen of nitrous, which exist into the composition of the tree and form the ashes when the substance of the tree is burned. It is transferred from the roof-hairs into the roofset, bisses into the larger roots, and up into the brunches and line and through the leaves. During its passage it losse, by evaporation, an immense percentage of nontierus, which plasses of it in the form of the contraction of the contraction of the con-traction up that it and the desired prevention of the contraction of the contraction of the con-traction up that it and the contraction of the con-traction up that it and the contraction of the con-traction of the contraction of the con-traction up that it is not contracted to the con-traction of the contraction of the con-traction of is movem up into its elements or nyurogus and oxygen.
All is also forced simultaneously through the leaves;
and during its passage it parts with the carbon dioxide
that was intermingled with it, and emerges as pure
air, while the carbon dioxide unities with the hydrogen. air, while the carbon dioxide units with uss averages, thus forming starch. The carges thus set free emerges in the form of comes, the insoluble starch is trans-formed into souble sugar, as occusion requires, and forced back into the sax, which besceforth is known as "elaborated" sax, and which forms the food of the tree. In this form so much as is needed for immediate growth is extried to points where new tiasue is being made, and the remainder is stored for future use



1 Emptying a tree-busket of its sap. 2. Gathering palls of mp from the tapped trees. S. Inside the sugar house, showing the great easi-from helier or evaporator. 4. An enddoor mp holim Glimpses of New England's outdoor cold-weather industry-maple sugar production

out, so constructed as not to interfere with the flow spout, so constructed as not to interrete with the now of the sap, is driven tightly lint the tap-hole, and a bucket made for the purpose and usually of the is suspended limediately below the spout. The sap, be-ing forved from the tree by internal pressure, trickless through the spout and falls in little droplets into the bucket below. The buckets usually have a capacity of Success below. The buckets behalfy have a capacity of from 12 to 10 quarts, and it is rawly the case that a sufficient quantity of sap flows to more than fill a bucket during the 24 hours which intervene between the times of pathering. Many maple sugar makers make a practice of tapping the largest trees in two or more places, claiming that a greater amount of sap is thus obtained.

Botanists recognize something like 100 species of the maple tree as inhabiting various parts of the globs. And it is a common characteristic of all of them to And it is a common characteristic of all of these for pield this sugar-bearing any IT wounded curing the dormant period and under certain atmospheric condi-yated the any in sufficient quantity and purity and of a sufficiently high sugar content, and that is closely cough gasociated in large numbers to allow the profit-able manufacture of maple sugar. This is the sugar maple, the hard or rock maple of the lumberson, its

two England's colleges colleve colleve industry—maple sugary production.

Into the maple tree will juicid it says carly drawing it is more than 10 of the beaves, and infraseced by the contract period, and even there only under atmospheric conditions which include bright, clear days designed in the complete conditions. The conditions which includes the principal conditions which includes bright, clear days designed to the conditions are proposed to the conditions previously and the conditions previously mentioned. And becomes the north these conditions previously mentioned to the conditions previously mentioned to the conditions previously mentioned. And becomes the presentation of the conditions previously mentioned to the conditions previously mentioned. And the conditions previously mentioned to the conditions previously mentioned. And the conditions previously mentioned to the conditions previously mentioned to the conditions previously mentioned. And the conditions previously mentioned to the conditions previously mentioned to the conditions previously mentioned to a feate of absorbed to a feate of a feater absorbed to a feate of a feater absorbed to a feater of a feater absorbed to a feate

ole Wheat Bread-Without Flour

MAN for sign has made bread by servers! methods— MAN for sign has made bread by servers! methods— recent distribution consists in the methods which may be grouped under the town "the methods which may be grouped under the town "the modern untiling indusbe grouped under the term "the many bave been in ercial than hygienic.

An examination through the microscope of a grain

at will reveal that there is a white central norof wheat will revent that there is a white central por-tion, protected by two envelopes. Between these en-cologies is however ministrance. Ourside them is the evolution of the contract of the modern them and an additional contract with the case the modern them as white four, and with this in view only the central part of this grant is retained, the cylinder muchinery climinating the two envelopes and the material between them. But the and fact is, that in this space between the savelogs less the major part of the matritus value to the contract of the contract of the contribution of the tension of the contract of the contribution of the contract is the contract of the contract of the contribution of the tension of the contract of the contr rt to get a white flour and a white bres

in the effect to get a white four and a white broad. The test of the vitamine content of food in a simple matter. It has long been known that pigeons, me, rois and guines pige, bed swiely on centurary white bread of the property of the property of the content of the broad of the content of

For many years specialists have been of the wheat berry, while keeping the broad white and soft. Knelff made white read in this way, but it was not soft it required supernormal teeth for its mus-tication, in fact. A later scheme, known as the Mege-Mouris method, failed because of the claborate process of fermentation of the grain which it employed. A new system now put forward in France, how ever, gives great promise of providing the solution. It eliminates all slow sifting to free the grain of the bran, and in three distinct operations of washing, macerution and rifting, which can be carried on simul tune usis, in a machine whose cost is so low as to be within the reach of all it has developed a practical way of conserv-ing the gluten and the vitamines of the

The washing not only cleans the gra but makes it easier to crush the bran and peel it off from the kernel that con-

tains the nutritive elements. After the washing, the clean wheat is macerated to bring it to wanning, the clean wheat is macerated to bring it to the necessary degree of hydration. Slifting then re-places the ordinary milling process, separating the bran from the pulp and leaving with the Intier the highly nutritive portion between the outer onvelues.

nutritive portion between the outer chevelopes. The most startling feature of the new process is that its product is not flour, but actually dough. It contemplates the elimination of flour from the domestic economy, and of the flour mill from the industrial establishment. lishment It contemplates that the housewife buy the whole wheat berry just as it now goes from the

thresher to the mill, thresher to the mill, that she pour these kernels into her machine, and receive out of it the dough for her bread. All the nutritive bread. All the nutritive values of the wheat are re-tained, and the useless and indigestible chaff is discarded at the same time. The machine is no larger than the ordinary family washing machine, and like so many other household utilities it can be operated with the current from the usual electric light socket

The main part of the mathine consists of a large per-forated drum into which the wheat is poured through a funnel. The grain grees through a continuous crush of the period of the period of the period of the per-turbance of the period of the period of the period of the notes which produces from 25 to 30 kilograms of 6 ugh per hour. While the dough it thus being prepared in the matchine, the bran is sequented out and falls into the matchine, the bran is sequented out and falls into ously from another opining Ti

is goody for the usual leavening process, and in half



the fact that observations could not be made with regu-larity over the drying period which often occurred late at night. In an attempt to overcome these two factors H A. Gardner of the Paint Manufacturers' Am ar ii A. Garmer or the Paint Manuracturers Asso-ciation, has experimented for several months to develop an automatic drying time meter. Several types were designed and constructed before one that would give satisfactory results was developed. It will be noted in the illustration that the apparatus
consists of an alarm clock device fastened
on an upright base. Attached to the hour

on an upright base. Attached to the hour hand of the clock is a very lightly conhand of the clock is a very lightly con-structed wire wheel covered with a cir-cular drum formed of light tin plate or of aluminum. The drum is stotted to re-ceive the test plece upon which the cont ing is applied t is applied. This winds under the indrel rod at the top of the druin and numers so if the top of the drin and is pressed in contact at that juncture with a sheet of soft light tissue paper of the same width as the tent piece. Both of these are automatically pulled from an adjoining double shelf stand, by the action of the clock Just so long as the conting is wet, it will stain the tissue paper at the point of junction, the paper adhering quite tenaciously to the film. Just at the point of itrm setting of the coating the paper will no longer be stained when it comes in contact with the test piece and will not adhere there to during its subsequent jour

nest berry
The test piece developed for this work
fire a trial of man materials, consists
for a roll of celluloid moving piecure film
(mate short ends of undeveloped raw
stock) that has been light struck but not developed.

stock) that has been ight struck out not developed. This material was selected because of its opacity (white sliver conted surface) upon which, applied clear con-ings are quite evident. Because of its great smoothness of surface, paint and varials coatings do not penetrate of surface, point and variable contings do not penetrate it, but dry used the surface somewhat as they would upon glass. Moreover, the solvents usually present in and they seem to experie to the same time as they would from the or glass. Rolvaria of the safe time as they would from the or glass. Rolvaria of the select type, or exciton-centraling solvents, such as may be used in lacquere could not be used. Moreover, such film is of a standard size and character of finish and is obtainable in practically any part of the country at a low cost from moving picture firms.



Internal view of the machine that makes dough from the whole wheat berry The exlindrical drum is removed to show the rotary crushers

an hour may be put in the oven. The brend thus oban nour may be put in the over the bread thus ob-nihed has an agreeable thate, it is not pure white for it contains the inside cover of the wheat kernel. It seems probable, however, that in housewife of today is educated beyond the point where a snow white color stands in her eyes as the hall-mark of purity and

quality

While the experimental work has been done entirely on the home-sized model, the new method does not necessarily demand that the housewife make her own bread. The machine will presumably be obtainable

in large sizes, suitable for bakeries of every magnitude from the small village establishment up to the factory that makes bread for a city This factory will derive the same advantage in making bread direct from wheat, and in making bread with all the wheat in it, that the in dividual housewife would

enjoy The two figures in the r development are Messrs. Pointe and Navarre, two well known French scientists and engineers.

Measuring the Drying-Time of Varnish

THERE have been die putes among producers and consumers as to the dry ing-time of paints, enamels, oils, and various variata products. Many of these here been due to the fact that the method of determining the dryness of a film

Tarnishing and Detarnishing of Silver

Title Bureau of Standards has recently made an ina vergation of the Department of Agriculture. This investigation has shown that the tarnish ordi-narily observed on silver is the suifide film of which narry osserved on slive is the sumoe but of the certain colors are characteristic and indicative of the extent of the tarnish. The effect of hydrogen suffide gas by liself on sliver is relatively small, but if small amounts of moisture and sulfar dioxide are present nmounts of mousture and source motivate are present the action is greatly accelerated. Tarmishing is also made more rapid by the presence of alkaline films and soap films. Conditions for producing a standard re-producible farnish were found, and the weight and

productible furnish were found, and the weight and thickness of the turnish film were calculated. In studying the methods for detarnishing silver appeal attention was given to the electricity in methods, reported that the studying the selectropy of the selectropy of the electropy of the electro for the electrolytic process were compared to determine the rate of cleaning and the possible corrosion of the



The drying-time meter, with inset showing a piece of marked film removed from the appearates after a test of the drying-time of varnish. Note the sharp line at which the times ceases to adhere to the film



Precision X-Ray Apparatus

New Means of Rectification and Voltmetering that Take the Guess-Work Out of Roentgenology

ENTGENOI OGISTS today are taking in creased interest in \ ray therapy \ \ ray apparatus which has been offered as an instrument in the rapy has not attained the high degree of engineering perfection which our knowledge of the subject warrunts. The medical practitioner is able to have his dosages measured with ease and accuracy within on part in a thousand, whereas his brother, the Roent-genologist, has been forced to measure his in almost

grandigist, has been forced to measure ms in amount unbellevable crude puresses.

One of the variable factors that has not heretofore under fuself amenable to precise freatment has been the constancy of the wave-form in retification. We have beard much about the long wave and the short wave

It has been pointed out by adequate authority on numerous occasions that pointed spark gap variations are not alone unreliable because of electrical conditions, such as oscillations, which occur in the circuit—but that they are also greatly affected by atmospheric

and by changes in operation as the points begin to wear away Because of this a strong agitation has been set up for the use of sphere gaps as a istans of measuring the par allel spark gap of an X ray machine, instead of the older pointed gaps. All high ten sion mechanical restifiers heretofore constructed have nerectors constructed nave been essentially revolving pointed spark upps. It is, of course understood that to fit this definition the electrodes do not necessarily have to be actually pointed but that they just have substantially small surfaces very small balls, for instance, might be hells, for listance, night be substituted without gettin, far away from the inher-ently bad characteristics of true points. To get entirely away from these difficulties the surfaces substituted for dap points must be decidedly large. The thought which has suggests itself is, then, to design a rectifier which has the characteristics of a

sphere gap and not that of a pointed gap. By doing this we may not only diministe the inconsistencies—the needle-point gaps, but at the same time substantially do away with the cereon discharge and with the obnoxious generation of oxone and nitrous acid accompunying it

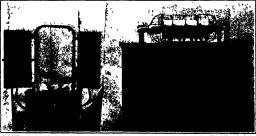
The practical result of some such line of reasoning and principal result of some anion may or removing on in embodied in the above paragraph is displayed in our first photograph, which illustrates a rectifer newly designed and now on the nurket. The spheres are stationary, and the revolving spheres have been re-placed by 'toroldal segments —to adopt a rather math-ematical term—which they in resulting generate during that part of their path that covers somewhat less than in full smiler let A further advantage, appearing on larger tion of the figure, is that rods are used for all connections. With the spheres for the stationary elec-trodes and the segmental torolds for the revolting ones, then there is no place for corona discharge into the

air, and no current is conducted through the shaft
After we have introduced a rectifier that meets our requirements, the next thing is logically to think of means for accurately measuring the energy developed.

The sphere gap cannot be used as a m with accuracy, where the circuits have large charging currents. Further, the sphere cup when used as a volt-meter requires such skill as to introduce a considerable meter requires such skill as to introduce a considerable-personal equation. It is not possible to arrest the re-member of the spheres immediately on spark-over, and the reading observed depends upon how soon after spark-over they are arrested. Furthermore, a sphere appearance for read continuously during frestment, for it requires sparking over, the noise of which may righte the patient, and, moreover, it necessitates turn ing off the current to extinguish the are—which is quite impracticable.

When Fortescue first suggested the sphere gap as a means of constraint voltage, it was necessary to deries a means of calibrating sphere-gap voltmeters. The interest of the sphere-gap voltmeters, the sphere-gap voltmeters are specified and reconstraint of section with the sphere gap voltmeter of a milliammeter, the latter being calibrated discretly with creek thirtowis. Ultimag this which may be roud at all times without discretizing the line conditions, and which will independent of the line-charging current as well income the sphere gap with the sphere gap w When Fortescue first suggested the sphere gap as a

Accordingly the manufacturers of the precision X ray outfit with which we are engaged have developed this air condenser in a fork suit-able for use on the instru-ment as a voltmeter A subset sphere gap is included as a limit gap for the machine, and further as a means for checking one creat measure-ment against the other if de-sired. Thus we have finally a constant form of rectifer which may be deper on, a direct-reading cree seter, and a prothe best accuracy of the best accuracy pussions. The whole apparatus ought by all means to put X-ray practice upon a basis of precision fair beyond anything which has yet been approached in this important



The external aspects of precision X-ray apparatus now at the disposal of the practition

THIN the past few months the daily papers have been publishing news items with publishing news items with reference to the drug adrenalin and its remarkable life-restoring properties. Adrenalin has been halied as the rules of the dead. It has been endowed with most mysterious

the deed. It has been endowed with most unjectedum and wonderful properties. In fact, the publicity has been so strong and so widely distributed that people today must think of this "new" drug as surt of preter natural substance, perhaps something like the funct schemists", philosopher's stone or cliut of life.

stehemists' philosopher's stone or clixir of life. The truth of the natter is first that derennin is not the new drug that people generally be lieve it to be its prominence in the day's news is due to the fact that certain physicians have lately experienced con that certain parketans have tated experienced con-siderable success with its use in revivifying the dead, especially in bringing to life bables that were appar-rally born dead. But the properties of advenuin have been known for at least 50 years and applied for at

Adrenalin was first discovered in the suprarenal by the French chemist and physiologist The suprarenal gland is a ductiess gland in 1895. The supriredni global is a duction chain whose exact function in the human and adjustables only been partly understood within the past few years. It secretes a substance known as advantin epinephrine or suprirednine, which possesses most fusepinepairine or supraredine, which possesses most fai-cinating preparties. It is a great energizer or stimulant, serving to contract the arteries and in rans the blood pressure. For example if the brain is informed of some great danger threatening the body, or if it registers great fear the impulse is transferred by means of the won-derfully swift and sure carrier nerves to the supran and glands and they are called upon to discharge the stance into the blood current to energize and stimulate the muscles into powerful action. Anger also results in activation of these glands and this is why the doctors tell us that anger is bad for a person with high tors ten us that anger is oan or a person with ingo-blood pressure, for anger serves to accelerate the secre-tion of adreanilis which has the power of further increasing the blood pressure. This also explains the extraordinary strength of the insanc. Adreanilis was first prepared from the suprareal glands of animals, such as bullocks and slavp, and the

fact that it will increase the blood pressure was first observed in 1804. It was not, however, until 1900 that meserved in 1808 at was not, access, into these into the distinguished Japaness physician and chemist, who recently died in New York City Dr. Jokkish Takaming succeeded in loolating the active principle of the supersynal glands. This feat made it possible to study the physiological effects of the substance and its real city.

Adrenalin, the Drug of the Hour

ical history starts with Dr Takamine's preparation of the cristalline substance adrenalin. These cristals the crystalline substance adrenain. These crystals are white and dissolve with difficulty in water. Adremain solution has a bitter taste and its slightly alka line. It is found in three chemical forms, and it is important that it be manufactured in the proper form,

important that it be immutaded ord in the proper form, ord all have the same photological activity, or an experiment of the same photological activity of pre-paring substailin. The drug lie extraorder from the superareal glands of shoop or over or the fit is minimized the superareal glands of shoop or over or the fit is minimized experiment to be an an interest of the superareal glands to solve our or the fit is minimized to be a superareal glands of shoop or over or the fit is minimized to superare to be a superareal grant of the superareal grant to be a superareal grant of the superareal grant of Atract is concentrated by evaporating off the water Then alcohol is added to precinitate the impurities the solution is filtered evaporated further in a vacuum apparatus and treated with amounts. In a 6 s. hours adrenalin crystallizes out and may be purified by recrystallization from ammonia About 125 grams adrenalin are obtained from 112 kilograms of the fre About 125 grams of The santhetical process is quite complicated and need not concern us here but it was due to the processes that its uses were investigated for ther and its application in what is known as 'bloodless

most recent use for adrenalin, wherein it is injected into the mustles of the heart is perhaps the most startling of all the wonderful applications of this murvelous drug. It is chimed that the dead heart, especially in the case of the new born bals, is so stimuespectfully in the case of the new born bulls is so attimulated by the drug that it commences bearing again. The heart is a powerful organ perhaps the strongest muscle in the entire body for it must work incressmity and must be pilse to respond at times to the most severe demands. It is built very strongly and it can endure rough surget at mage even become what may be expected. as the other organs of the boly, for there must not be as the other organs of the body, for there must not be any suspension of its functions. The use of adrenalin renders important nid not only in heart operations but in operating on adjacent organs. In such cases the heart has been accustomed to be artificially administed by the surgeon who actually grasps it in his hand and squeezes it we as to produce a flow of blood through

Adrenalin is also of great help in operating on the

OUT the core and throat, where it is desire the core and throat, where it is desire the desired and previous of adreadin serves to drive the blood way from those parts, for it contracts the blood vessels and prevents a profuse flow. It also possesses the properties of an anneathetic, escartally useful in

Adrenalin is a wonderful drug. There is no question about that but it must not be supposed that it is a curreall and suve-uil for everything. There is no such unvail and saveall for everything. There is no such thing as a universal thrappette agent. Then again, advantile is not a universal "raiser of the dead" it is only in everythinal cases and under very special circumstances that advantile has actualty caused a dead heart to best again. The medical actualty caused a well many of its properties, and use it is many sup-formation of the properties and use it is many sup-formation and actual through the company. That some of them more courageous than the rest, have now and then applied it in cytraordinary ways and have produced really remarkable results with it only serves to emphasize that with a drug of this character no one is entirely familiar with all the effects that can be Care ful experimentation and trial may re still more wonderful uses for this strange substance.

Leather Produced From Degreased Hog and Sheep Skins The leather section of the Bureau of Standards has

THE leather section of the flurence or summarise may recently completed investigational work on the qual-ity of leather produced from degreeased log and sheep skins. In general the results show that the degreeating process is very efficient practically all of the gream being removed without apparent dumage to the ele-ments needed for making leather. Leather made from the degreesed skins is superior to that made from the natural skins, and the time occupied in tanning is reantural skins, and the time excupied in tanning is enduced with more effective results. Leather made remote described bagshine in equal in physical properties to describe a leather and the state of th

leather purposes

No published report is available on this work at the present time, but one will be issued as soon as possible and the notice of it will appear in the Technical News Bulletin of the Bureau

HEN Dr C G Abbon revenue stated that, as shown by careful observations and measurements, the heat radiation from the sun to the earth had diminished from

HEN Dr C G Abbott recently

3 to 4 per cont during the past fiftee namths this disclosure may have alarmed some third pessimists, but it caused no serious general apprehen slon. Many open), scoffed at the statement and ridi-

chied it in the observations upon which IP Ab-bott's satement was based were thoroughly rediable-low are they to be interpreted? Do they mean the in eight ur ten vears the sun a radiation with some per cent less than now and from freeding to death? Country to the properties of the properties of the country of the properties of the properties of the country of the Country was considered that diministration of radiation of the properties absorptions caused by certain merely as a passing phenomenon caused by certain disturbances on the sun for which science cannot

nunt? cientists, knowing how carefully the observations Secretains, knowing how carefull the observations and measurements of the sum's reduction, which were begun about 20 years not by the late l'ord. Landing and measurement of the properties of the properties of the landing and the control of the landing and the landing and the properties of the landing and the landing

At the same time, there I no ledger any count in the minds of our scientists that the sam, following the inexceptible laws which govern the evolution of stars from the cosme elements of nebule and their gradual devolution into cold and lifetiess stars, has progressed so far already on its devolutionary down-curve that its extinction is merely a question of time. But this need to the control of eximiting is mercy a question of time. But this need not cause any anxiety at the present time-our sun will probably continue to supply the earth with light and heat for millions of years to come. For what is a million years in the life bistory of the stars?

The Life History of a Star

tory of the origin and evolution of all stars is practically the same Our sun also is a star though in significantly small compared with others and its his tory so far as its main features are concerned is typical for all other stars.

Stars are believed to originate from nebulæ by the Stars are believed to originate from neousle by the condensation of the mass of elemental goines of which the nebulae constar. Spectral analysis has disclosed the presence of only three goines in the nebulae examined bydrogen, belium and nebulium an element unknown, as yet, on earth. Of all goses known, bydrogen and belium offer the greatest resistance to condensation by liquefaction and nebulium is probably similar in that respect. It is more than probable that other elements could not be spectroscopically identified in any nebula could not be spectroscopicing and nimet in any acouse because they could not exist in gascous form at the temperature of stellar space closely approaching 273 degrees Centigrade, the absolute zero. No evidence of the existence of the heavier clements in nobulis has the existence or the heavyer (tenerats in meculia mis-cere been found, but it is not impossible that they may exist in the center of the nebular mass following the haws of gravity, while only the rarefuel light cases surrounding the denser center betray their presence when made luminous by Hetrium wave passing through space. Whether this is really so, or whether the nebule, from which the stars are evolved, are com-posed in the beginning of the three gases above menposed in the osymming or in turve gases have inva-tioned only, while the heavier elements are gradually evolved from them by rearrangement of the structure of the atoms under the synthiciting effect of condensa-tion, is still an open question.

The condensation of the bujuar mass causes a con-traction of its volume and, as a result of the crowding

tractive or the volume and, is a result of the crowding together of the atoms, some sites hear. During the early stages of the evolution of the star, the nebular mass, still highly rarefully, the validly to the contracting influence of condensation. The mass shrinks rapidly, custing a correspondingly rapid increase of

temperature. During the steep up-curve which marks the evolution of the star the volume of its mass shrinks rapidly and its temperature rises from near absolute sero to temperatures estimated, in some cases, at 20,000, per-haps even 30,000 degrees Centigrade. The maximal temperature, which a star attains at the apex of its evolutionary curve, depends on the volume of its mass. The greater the mass, the higher will be the maximal rine greater the mass, the figure will be the maximal temperature of the star at the apsy of the curve. Our sun, which probably did not, even at the apsy of the evolution attain a temperature of more than 12,000 degrees Centignade, is now far advanced on its curve of decline it has become a dwarf among stars, with a temperature estimated at 5420 degrees Centigrade How insignificantly small our sun is, compared with other stars becomes evident from the fact that, for example the diameter of Betelgeuse is approximately 230 times that of Antares more than 400 times, greate than that of the sun

than that of the sun. That our sun is approaching its final extinction is beyond reasonable doubt for its mass has reached a high degree of condensation with a mean density equal to one and one-half times that of water or approximately, one fourth the estimated mean density of the corth

During the early stages of the evolution of a star its temperature rises rapidly until it reaches its maximum at the apex of the rising curve, but there is no cor responding increase in its radiation, as the rise of temperature is almost counterbalanced by the shrinkage temperature is almost counterbalanced by the shrinkage of the realisting surface. After the apt is in seed the rate of condensation distributes and with it to ten-ture of condensation distributes and with it to the large surface of the surface of the surface of the ing star abritals, its radiation becomes weak and finally conses altogether—the star has resulted the end of its career, has become a density surface of the condensation of the surface of the surface of the surface of the surface of cert it is impossible to forefully with any degree of cert

tainty, but the prospect need not worry us. Its radia tions shall probably continue to maintain life on our planet for millions of years to come

Stretching the Harvest Through the Winter









statement of the value of cannot frust, etc., put up by our connected cannot also be the value of the year 1921.

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Copper 2000 In lareshood in mentional baseding, is or by charles, could have be charlenged. The compartion of principles of expect of principles produced to the compartion to the above of the compartion to the above of the freezight should be harmounful, topper Boodere about 15 per cent of the real to his more than 10 per this limit is uniform.

Next year we ast energy cazard and dietel grouts, to the secure for Washwarth Ballings. The casa and cases are drawn to scale, the sides they would have to be to

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SCIENTIFIC AMBRICAN

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Our Reserves of Energy

The Heat and Power of the Future, Seen from the Brighter Side

By Leo G Hall



CORDING to authentic recent in formation, the world's known an thracite resources are about 30 per cent exhausted. The known bitumi nous resources are about 7 per cent cahapated. In addition to this there is a supply of lighte as yet pruc-tically untapped which is greater

than the bituminous supply. It is about a hundred years since coal supplies began to be tapped to any great extent. In that period about a sixth of the known coal supply has been used. How much unknown coul is stored away no one knows. But there is certainly a considerable amount in the un-veyed reaches of Siberia, China and Africa

Additional to all this there are great jent bogs on all of the continents which with the improved methods as or use continents which with the improved methods of unwardering now being put into use in Germany will form attill another fuel reserve. I do not mention oil and mutural gas, for they have never formed an important part of our energy requirements, and this are already apparently within measurable distance of exhaustion.

We are ovramiding our fuel demands year by year We are pyratubling our ruet demanus year op year. Every year sees more used than the year before. If that process keeps up indefinitly, it is, of course, only a matter of time before supplies are exhausted. But it will take much more rupid pyratubling time has occurred in the past to exhaust the coal, let alone the occurred in the past to exhaust the coal, let alone the lighte and peat, within the life time of any person now

Economic factors will however, grad-ually enter the field and stop the use of coal for fuel long before the supply is exhausted The coal we have mined to date has been that within easiest reach and which can be mined at lowest cost As these easily mined fields are exhausted, the cost of coal will go up. This rise in price may be retarded somewhat by im price may be retained somewhat in in proved methods of product from but it will none the less go on Gradually the cost of power from coal will exceed the cost of power from other sources not lithretto developed because not lithretto canddered economically worth while. And as fast us econonically worth while. And as fact as these other sources of energy become more worth while than coal power they will supplant coal power. The cost of coal power does not need to go very much higher before very large blocks of this

other energy are thrown into competition with it. It will interest us here to see what other large supplies of power are available

of power are available. The first and most obvious of these is, of course the power of rivers and waterfulls. Engler, I believe has estimated that the energy which might be taken economically from these waterfulls is sufficient to replace

estimated that the selecty whiten major the raises re-order the property of the property of the property of the object of the world's present coul demands. Note that word consonically. Reveat developments of effects to be the utrishes have already brought a nucleary property of the world's watercourses within the remaind fold and Engler's well-raised by the property of the contract of the world as portions and an approximate the property of the world as portions and an approximate the world as portions with the comparatively small increase in freely price, and Engler's estimate of the world as portions of the developments and the contract of the price of the world as portions of the world as the price of the world and will be developed. Developments now crede to only a quarter or a father of potentialities will be increased to full capacity when the price of power arrantal I all his all, with the price of fresh that little rivers and watercourses not far, if at all, short of the total full power requirements of todar.

tal fuel power requirements of today
While it has been objected that much of this pot While it has been objected that much of this power is too far out of the way for use, it is also one of the laws of economies that "if the mountain won't come to Mohammed, Mohammed will go to the mountain." But no wholesale changes of seet of Industry would be necessary. High tendes in unbusission of current for a thousand sitles is within the range of present techniques for commercial transmission over several hundred miles

In addition to the potential power of rivers and waterfulls, there is a vast store of perpetual energy in

the tides. Recent developments of efficient low-head turbines have rendered the development of tidal power-commits, and several very large (tidal-power plants are under construction in Europe today. The high tides of Nova Scotla are also being utilized in a considerable development in progress.

It is hard to say how much power is available by this cans but it is safe to say that a majority of the world's tidal estuaries and merow mouthed bays are capable of development so as to furnish their thousands of horsepower each. Probably power can be developed from tides in excess of what can be developed from rivers and waterfalls. And a large part of this power could compete in the open market with coal even at

It is at any rate certain that the above two sources of power alone are more than sufficient if completely developed, to replace the world's entire coal consumption and meet growing demands for many years to come But we have not begun to exhaust available sources of

How about foul for heating and the realisement of liquid fuel for internal combustion engines? The unswer to this question lies in sun power. I do not refer to the cumbersome machines which we are wont to associate cuminersome maximes when we are worn to associate with san power, but to nature's process of storing up sun heat in the augmentation and cellulose of plants, and the utilization of it by converting these substances into nicohol which can be used for fuel. Alcohol can be produced today at a cost, power unit for power unit,

And undoubtedly we will must of un live to use giant plants in operation on the chordless deserts of the senti-tion of the control of the control of the control of the control to great cities of central third Sistes over high tension lines at from one to two million voits, or per The coverage intension in the control of the Theorem of the control of the Discovery per square yard of surface, or a million threspower per square with Probably not more than 70 per cent of that can be precisedly realized. But power caught to napply the eartie power requirements. even at that, a single Arisona (County could produce power enough to supply the eatite power requirements of the finited Natus. I believe that our present de-mainds are about 1,500,000 horeover. Probably the minds are about 1,500,000 horeover. Probably the 100,000 four horeover. Yet there is solar energy again to waste on the deverts of the word sufficient to supply several billion horeover continuously, with the purper storage and transmission facilities. It could be done today. It would be done today, it the domand were sufficient.

were sumcient.
There is scarcely a district in the world that is not within trunsmission distance of large supplies of tidal power, river power or solar power. And there are still other large available supplies of energy.

During recent fuel shortages several successful wind.

During recent fuel shortages several successful wand-power plants were built and operated. Becent ad vances in the art have made it possible to do away with the old cumbernome stiff windmill and substitute a sort of whol turbine which our fuel ficiently under a much greater range of wind velocities. Improvements in gener ating apparatus make it possible to genating apparatus make it possible to gen-erate and store a uniform current from an exceedingly variable source of power. The time may come when every household has its wind plant on the roof, with storage batteries in the basement, to furnish power for lighting, heating and cooking age batteries in the basement, to furnish greateries of even in deal, the second could be a second cou

but weiter section interest volume to the variety but weiter section interest volume to the vorial fifteened parts of the world. Exceedingly high temperatures are reached in some places by simply drilling a few thousand feet. In Italy a natural stems upon a process of the variety of the process of the variety of the last process of the variety and practical use to turnish 1,000 homespower continuously practical use to turnish 1,000 homespower continuously practical use to turnish 1,000 homespower continuously and the continuously of the process of the pro

VERY little while some well-intentioned alarmist tells us that our fiel resources are within twenty or thirty years of exhaustion. He then draws a limb word picture of cold homes and stilled wheels of industry Consequently there is a widespread popular belief that the next

uduity. Consequently there is a widespread popular belief that the next tenth years, or fifty at the outside, will see us in the cold unless we take immediate strensous measures to utilize other large supplies of energy which is the control of th

about a third of the cost of gasoline. It can be used in any gas engine with a small adjustment of the car-

ann gas regific with a small adjustment of the carman gas regific with a small adjustment of the carman of

of present guardine manufacture. Wheever the am shites there is potential alrohol. There are still other accurse of power which will be There are still other accurse of power which will be There are still other accursed to the still a sti

An Automatic Exposure-Meter

Exposure-Meter By Dr. Alfred Gradeswitz

Control of the control of the control of the control of any small life control of any small life

of the objects or sceners to be photographed being appreciated, rather than that of the entire picture as a whole,

a wrone.

Thus suppose the water-scape herewith is to be photographed, the circular frame being, to begin with, left out of account. The time of exposure should be so thosen that the darkest portion of the picture, the fringe of the forcest in the background, is

frings of the forest in the background, is reproduced with some detail for the other hand, exposure should not be probaged understanding the background of the picture, the salls, to be over-exposed to the picture, the salls, to be over-exposed to the picture, the salls, to be over-exposed to the picture and a correspondingly uniform white on the positive print. Generalizing the intens of exposure should, in any case he on the positive picture selves a given maximum and the picture below a given maximum and the picture levels a given maximum and the picture levels and

This is the fundamental principle underpling the construction of Dr Schlichters new nettometer. In face, when pointing the information, which in outs and appear which is the property of the principle of the security to be photographed the picture seen through a bise filter surrounded by filtree checking sectors, as in our example—a bright a medium and a dark complete during sectors, and is not need for checking purposes and is not used for checking purposes.

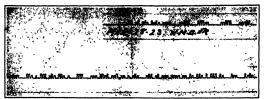
The chesking sectors are no graded with repart to one another not a correspond exacety in brightness with respective degrees of Illusiumstron at which in possive de at the northin possive de at the northin possive de at the northin possive as a second possible to the northin possible as at the northin possible as at the northin possible as a second possible as a second possible as a second possible as at the northin possible as a second possib

through it the left stop, so as to have no portion of the pletter remain beighter than the leight est, and no portion darker than the durkest of the threecheding sectors. In the sample pletters here also which is rather rich in contrasts, the saits should be of about the same brightness as the beighters, and the of about the same brightness as the beighters, and the pletter of the same brightness are the beighters, and the large sector, while the water sheet receives the average that corresponding to the medium-brightness sector. The

adjustment thus obtained is read from the scale b This bulancing operation reduces the picture as a whole to a single brightness.

Now, the light serving

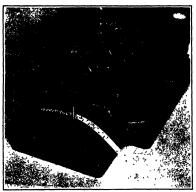
New, the light serving to illuminate the checking sectors is nothing else but the daylight in the space in front of the instrument. Its absolute brightness can be satoritained by gaging the blackening time of a space of the sector of the instrument. The scale-resting on b and this blackening on b and this blackening in a mat are next as a



A specimen of the transmission of the newly proposed telegraph code

justed to one another the ring of being turned until the two figures angear beside one another on the left and scale. The proper time of exposure is then read from the same ring (on the right hand soel) at the point that falls opposite the number corresponding to the objective stop used in the camera

The instrument has the shape of a small telescope



The transmitter that would make the new alphabet applicable alike to cable,

and is mostly made of light no (a) thus weighing only about 1.50 grains. Its main distinctive features, as of the second two control of the second two control of the second two control of the pictures of the picture with the backening of the heightness of the picture with the backening into of the photometer paper. In fact the instrument constitutes an actual photometer of known accuracy and, accordingly eliminates all presents all presents equation.

Doing Away with Dots and Dashes By S. R. Winters

CW EEPING revision of the So method of transmitting the Morse alphabet with respect to radio telegraphy, and submarine cubing, was resultant and the submarine cubing, was rectified of the Way and the Way of the Way Department, in a before before the National kvadeny of Sciences. The mount of the Way of the Way of the Way Department, in a before before the National kvadeny of Sciences. The mount of the Way of the Wa

spaces to a common duration. Flots, dashes and spaces would be distinguished not by duration but by variations in the intensity of the signals.

The different intendities in a dot dash, or space, under the proposed new system of signalling, would be effected by the use of alternating electric current. Each half cycle or arbitrary multiple of a half circle would represent one of the three individual send

ing i bemetis, depending upon the intersity. These different intensities are, of course accomplished at the transmitter that the control of the control of the transmitter of the course of the course of the mental application in submartine cables and a means provided for interpreting the afternating current into understandable afternating current into understandable of terrational Morse code, in the aventue is terrational Morse code, in the aventue of the government of the sending of the in great control of the providing of the ing described in two adjector signals are of the same sign, since each semi-specie of the course sign, since each semi-specie of the course sign, since each semi-species of the described of the course of the same sign, since each semi-species of the same sign, since each semi-species are

and thank or spaces of the Signal Corps of the War Department in amplifie this novel form of telegraphic alphabet to subnaria, colling desovered that "Other things being equal, the variations in interesting the superior of the colling of the signale are reduced to the minimum on the theory that the minimum possible change of the fundamental wave should change of the fundamental wave should change the fundamental wave should change the fundamental wave should stread to state which amounts to a series of the present cable letters "of or "a" string function that will be a string to the present cable letters "of or "a" tring function of the present of the present for the reason that a sink sine way to triend circuit without distortion of any triend circuit without distortion of any triend circuit without distortion of any ways. In the sor transmitted."

unto that is so transmitted."
In striking contrast is this contemplated system of telegraphic signalling to the method now in force. The powerful radio-telegraph stations, for instance do

not attempt to correlate the actual scaling of the dots, and spaces with the phone or mapply of electric curvat entering the transmitting antenna. The teledupon of the antenna curvent. Thus, in the transmission of one message a relatively large supply of electric energy in the antenna may be interrupted at widely carried to the contract of the co

nepatite Many of the cytoling distributions in the ether, which must the suddle reception of radio telephone message that the suddle reception of radio telephone message that the suddle reception of radio telephone message that the suddle reception of the suddle reception of the suddle reception of the ether with "much or harmonics Coupled with this condition in the suddle reception of meritain powerful radio-telegraph stations ("restated on page 246)



Left: The complete apparatus. Right: Typical example of what one sees in the eye of the actinometer, with the reference fringe of varied shading

The automatic exposure meter and the way it works

The point in Fort Washington Park from which S. F. B. Merse strung his experimental wire across the Hudson

WE walk along Riverside Drive in the neighborhood of 158th Street, New York's beautiful river drive we look down on

beautiful river drive we look down on what seems to a stranger to be a rrain shackle old mansion swept into a circle of retaining wall by some quirk of the tide to to to those who live near by for they know that Audubon spent his last years in the house, and that here Morse carried on

tch graph transmission In 1842 John James Audubon, then 62

in 1842 John James Anduben, then 62 years old, purchased a tract of 24 acres for out of the city and on the Hudson's bluff bank. Adubton thought that at last he had an idylife spot to puss the remainder of his days amid orchards, a bubbling brook, and a tina watefall 'so he named it 'Minnite' a Land, 'Minnite' Minnite' alma', 'Minnite' and 'Minnite' in named it "Minnie's Land, Minnie's being the Scotch word for mother All went well for a time but the railway channed for an entrance into the city, and why not take the water level and travel along the river? Soon the beautiful words bonds were set the set of the control of travel along the river? Soon the benulitary sandy beach was cut through rubbessly and Audubon had to build a plazza on the other side of his house to blot out the new symbol of dellisation Of course Audubon was advancing in years, but he Audubon was advancing in years, but he still painted in a room on the north side of the house where the buy window is now, and here some of his explaite pic-tures of birds and animals were executed. To this house came as a welcome guest another painter of no mean order, ai-thought a portrait painter. His name was Mores, and he was dabiling in electrical

Mores, and he was dabbling in electrical representation. The hundry on the south side of the hunse, on the ceilar level, was a side of the hunse, on the ceilar level, was more of the south of the sout coming to see Audishon, at any rate this ding, laundry now entirely boarded up is an important link in the history of long distance transmission. He Reginals Pelhum linkins, a historian of New York, whose guide leads into the centrated Audithon park, took the leads into the centrated Audithon park, took the Morree crossed the Ilinkins, with his aertial views. A walk of about a mile led into neglected Fort Washing too Park, and after crossing over the railroad hy an open cut, which must have been a triumph of engl energing in the entry days, we began a search for the roak where Morre stopped his mast. At last it was every able to history that it and also the eye-boiler for round, and arrer the leaves and earth were dig out were able to photograph it and also the epichilit for the gar-ropes some distance away. The mast make been of great height as the hole in the rock is over two feet in diameter, and while not deep served to hold the mast thoroughly firm and querisht, with its aid of the gay ropes. An early work on the electric telegraph developes some of the difficulties encommered

as follows

"For a long time the disputches were carried over
the river by messengers in boats, but finally, the line
was submerged by Ir Ears Cornell in leaden pipes,
the wire heling covered with cotton, and insulated with
India rubber This was November 20, 1840. There
were two cables thus formed, and they worked very
was fire several mustle, null they were carried away
was fire several mustle, null they were carried away

Relics of the 1840's

An Interesting Chapter from the Early History of the Telegraph

By A A: Hopkins

by the ice in 1846. They crossed the Hudson at Fort Los, some 12 miles above New York City When these cables were broken, high musts were erected and wire upon them was stretched across the river Men were across the river Men were in attendance all the time to repair the wire when broken by vessels. It was the cus-tom to let the wires down

tom to let the wires down into the water for tessels to purs and then to draw them up again. This was practicable in tide water, but not so with the inland rivers. The Hudson river at the place of crossing was rivers. The Hudson river at the place of creasing was 2700 feet wide. These masts were constructed under the direction of Mr. Henry J Bogers, the correction superintendent of the telegraph. In 1847 another ef-fort was made to crease the Hudson with a cable, and

part the Audubon House, and along New York's "back part" as it were. Much of New York's fright, appearance that it were. Much of New York's fright, appearance train a day in such direction ras must be officiently brought on by the war rendered it this consensus that the officient branchists. Andebon linearif lies to protect the Franchists. Andebon linearif lies few bundred feet away. The Audubon House should be preserved as a monoment to a great naturalist and a great in travallet, but the ravages of time will soon wipe out this very fineeracting landscape. Something About Calories

WHEN close are mentioned in notificia, it is from the form of the

returner (1883) were apparently the mes-to use the term calorie as it is now ap-plied in the science of mutrition. Rubner made three outstanding centributions re-garding the calorie in nutrition (1) He applied its present-day meaning to the term. (2) he determined the caloric value term; (2) he determined the calorie value of protein, far and excels/prients, figures which are widely need in determining the energy content of a dist, (3) he drew the energy content of a dist, (3) he drew the physiological heat values of foods. By absolute heat values in distribution of heat yielded by a substance when outsided in a both contentent; the amount of heat preduced by the substance when outsided in a both contentent; the amount of heat produced by the substances in question when the produced by the substances in question when the produced by the substances in question when the produced within the salmant body term when the produced within the salmant body that the produced within the salmant body the produced and the produced within the salmant body the produced and the produced within the salmant body the produced and the produced within the salmant body the produced with he regarded as its physiological heat value.

These values may or may not be identical, a fact which is of fundamental importance in the science of nutrition

In the science of nutrition Calorie as a mere word explains noth-ing. It is a symbol for an idea, however, which, as we have seen, has undergone changes brought about by the devalop-

changes brought about by the develop-ment of several sciences. Ancient and have notions requiring the phenomenon of the same phenomenon of the same phenomenon of the other-principle of the same phenomenon to the other-principle of the same phenomenon of the other-principle of the same phenomenon of the same phenomenon of the folds. The bistory of the calorie in nutrition, therefore, in wrapped up in the bistory of nutrition tieseff and the randomental natural sciences upon which this branch of nutridege rear.



The famous Audubon House on Riverside Drive, new left dews in a hollow far below the permanent grade, and falling to ruin. In this house Morse did much of his work upon the telegraph.

to that end a copper wire, covered with gutta-percha by Mr S T Armstrong, was purchased and submerged by Messra. Th Clark and J W Nortons for the Magnetic Telegraph Company. The cable was placed across the river at the foot of Cortland's Street. It worked for Just one day, and was then torn away by an anchor

"On the lines constructed by Mr Henry ORielly throughout the great west, many rivers had to be crussed, over which the wire was stretched. The widths of these streams were from 1000 to 3000 feet. The first crossing was that at Wheel-ing, over the Ohlo river, 1800 feet, the next was that over the Ohio at Louisville The

So the railway and the telegraph were early placed in close relationship, Moren's must corrolocate a gigantic engineering work, for the time. This, the only railway into New York proper, was for a long time along the Budsoo, the trains running through Silventh Avenue to the depot at 50th Street, and here Innovin Silventh a body was brought through the out and No the railway and the



One of the bolts to which the guy rephs for the me

A Plexible Ciutch for Ma-rine Dissel Eurines

MONG the new features introduced into United Bratis supportance recently completed is a new type of feerible friction clutch. The basic principle involved is that of the application of friction between two grooved friction untwent two provent surfaces, one being the inside of a dram and the other, the moving surface, being a series of shoes moving radially from the center of rotation. The convoluted surfaces are to give increased friction in a

give increased friction in a minimum of apaco.

The apactal problem arising in subsarine operation, at which the new cletch is directed, is the need for a connection that will allow facility in case either the motor or the engine should be subject to insultaneous, following my deformation be subject to misaltnessent, following any deformation of the skip's structure from her conditions, pressure when submerged, or wear in the hearings of either of the main elements. It was also necessary to have a connection that would absorb or deeden vibrations in case the Suywheel of the engine, acting in opposition to the rotating weight of the electric-motor armature, should introduce tousional vibrations in the intervening should introduce torsional vibrations in the intervening shafting, resulting in crystallization and breakage. Also there was needed a connection capable of engage-ment and disengagement while under way During the war the problem here stated was acute,

Defined the experience of the problem horse started was each to true solved only in a temporary fashiot, by use of a clatch of the multiple kw type, in which the example of the experience of the control of the experience of the

colors, and it has since carried the 3-2 on a voyage of 8000 miles from Portsmouth, N II, to Hawsill—the longest straightaway trip by a submerable. The contra-tors, as a result of this, have been instructed by the Navy Department to equip all subsequent submarines

Navy Department to equip all subsequent substances with the new clutch.

To appreciate the importance of having, on submarines, a clutch that shall not substantially as does the clutch on an automobile, it must be noted that

the clutch on an automobile, when coming to the surface from a submerged run the vessel, if equipped with a plain jaw clutch, must apply the brake to the propeller shaft in order to bring the jaws in line with each other before engagement. In the presence of an enemy this loss of time may be futal. Vice versa, when diving, disennent cuit commence begagament can commence se-fore actually stopping the en-gina, the motor get under way in advance and engaged without stopping the propeller, again saying valuable time.

Referring to the drawing, por win the innowing or-mores radially in platon-ine guides D. P and engages in groved inner surfaces of the shoe and show-the.
The stiding shore P is sted with each shoe-



The United States submarine S-2, driven by the new clutch that engages and disengages in metion, just like an automobile clutch

each end, and with a helical spring R mounted on ea link to permit of adjustment in proportion to the load to be carried. This adjustment is effected by



arel view of the new clutch showing the redially.

dismounting the cap F and removing the guides D,D. When the load is engaged, the link first moves the shoe radially outward until the friction surfaces make

contact, then continuing in it. contact, then continuing in to motion, it compresses the spring until the proper tension is reached, in proportion to the load to be carried. The hole for the pin in the outer end of the links Q is clongated to allow play between the and the shoe-carrier This re-lieves the tension on the spring when the clutch is released, and allows the link to pull back the shoe when the load is withdrawn.

When the she the link Q can be adjusted by withdrawing the lower pin and unscrewing the lower link A A, until the desired length is obtained to compensate for the wear. The friction shoe B, carried by the shoe-carrie

b, is so constructed as to permit sufficient lateral move-ment to allow it to center itself into the grooves of the rim. The driving member K and the driven member J are not connected to hold the center rigid, so if the steady bearing L by some unaccountable reason drops slightly, the flexibility of the springs will permit the

slightly, the flexibility of the springs will permit the clutch to run silt engaged. Chetch to run silt engaged. The counterbalance weights B offers the centrifterman of the control of the counterbalance weights B of the control clutch diseasement when in motion. The worm-driven mechanism V-C0 is used only for large power the worm-when N runs between habilitted arrafaces in the cassing M, and also the shifting slewer O. It is not necessary to run this clutch in an ol-leath, though lib-count N is the control of the counterbalance N in the counterbalance N is not considered the counterbalance N in the counterbalance N is not considered the control of N in the counterbalance N is not considered the counterbalance N in the counterbalance N is not considered the counterbalance N in the counterbalance N is not considered as N in the counterbalance N in the counterbalance N is not considered as N in the counterbalance N in the counterbalance N is not considered as N in the counterbalance N in the counterbalance N is not considered as N in the counterbalance N in the counterbalance N is not considered as N in the counterbalance N in the counterbalance N is not considered as N in the counterbalance N in the counterbalance N is not considered as N in the counterbalance N in the counterbalance N in the counterbalance N is not considered as N in the counterbalance N in the counterbalance N in the counterbalance N in the counterbalance N is not considered as N in the counterbalance N in the counterbalance N is not considered as N in the counterbalance N is not considered as N in the counterbalance N in the counterb eral lubrication is required in order to assure the proper overload-slipping regulation.

Friendly Germs

OUT of about two thousand kinds of bucteria only about one hundred are believed to be harmful Without the other nincteen hundred life on the carth would soon die out We, as well as the animals whose would soon die out. We, as well as the animals whose fields we set, derive all of our sustenance from the vegetable world. Plants require that he self should deep of solar plants, which in turn for caused by bacteria, or germa. Without humas, plants establish themselves very slowly, so that if we were to kill all bacteria no more decay would take place. The soil would soon be exhausted and we should all die of starvetion.

In a more ordinary way there are many bacteria which are of use to us every day. They produce vinegar Lacid acid germs give the flavor to butter Germs help make choses. They help dignet the food in our stomachs. And, finally, they cause juices to ferment into sloohed, even in the United States with its adverse legislation

Harmful perms of many kinds are always in our systems, and this causes many people to worry, often
unduly The fact is, they
cannot possibly be eliminated.

cannot possenty to estimate a. Even if it were possible to get rid of them we should be in danger of killing with them the many good germs we must have in our boiles in order to live The first germs our most carefully protected food meets with are pixulin and meets with are ptyslin and epilepsin, which are always in the saliva Without them we should all be chronic dyspeptics in a short time, for they attack our food in a most satisfactor, part of digestion Therefore, efforts to keep the mouth "gerinfree" with tooth-pastes would be unsufe even if they could succeed. How-ever, when the germs are detics in a short time, for thes stroyed by the dentrifice a new supply is very son brought in from the saliva glands. And through the breath millions of new germs of the harmful sort come at once. If we keep our bodies in good health however, germs will give us little trouble It is only when they are present in abnormal quantitles, or when our resid e down, that they menuce t



Diagram showing operation of the fiexible clutch; the reference letters are explained in the text

Making Wrought Iron a New Way

A Mechanically-Operated Puddling Furnace which Does Away with Much Manual Labor

By Prof. Albert Sauveur



) SIMPLE is the operation required for extracting a small mass of metallic iron from rich ore that the primeval man may from rich ore funt the primeral man may lave discovered it by means of a five seed dentally lighted upon ground where iron or existed near the surface. Indeed the first iron furnace of which we have any record consisted in a single execution dug on the side of a hill

facing the prevailing wind with an opening at the bot tom for a druft. The treatment in this crude appliance of some rich iron ore mixed with charconi resulted in to note rich to be made with charge resolution of a small post; lump of tron mixed with sing, that is, of wrought from The simple furnaces which later displaced these rough devices were known as forges or bloomeries. A privace of this kind known as forger or bloomer's A. present of the late to the common of the

Such processes are known as direct, because they yield a malleable metal in a single operation from the

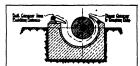
treatment of the ore. They remained the only method of obtaining iron until the fourteenth century, when the binst furnace came into existence In this furnace the treatment existence in this furnace the freatment of iron ore with a suitable fuel and with flux yields a product known as cast (pig) fron, which is not malleable. In order to convert it into a malleable metal (wrought iron or steel) it is necessary to deprive it of some of its impurities, notably of the large proportion of carbon it contains, an

operation known as remaing

The refining of east iron was first per
formed in a simple furnace not unlike the
forges and bloomeries used at the time
for the direct extraction of iron. The method was called indirect because it required two distinct operations in order to obtain a malleable metal. In these furnaces pig iron was heated in contact with charcoal and subjected to the oxidizcaused the expulsion of the carbon and other impurities and thereby the conver-sion of the pig tron into wrought fron These "fineries" remained the only meth

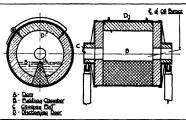
These "imeries" remained the only metricological conservation pile from into wrought from until the invention by Cort in 1784 of the puddling furnuce. The greater economy of this new process caused the finery methods to be discorded. In the ddling process the pig from is treated on the hearth pudding process the pix from is treated as the nearth of a reverberniory furnice, where it comes in contact only with the flame and gases resulting from the com-bustion of the fuel in a separate freplace, the metal being decurburised and otherwise refined through the

reing occurrenced and oxidisting action of the prevailing atmosphere and through the action of oxides of iron intro-duced for that purpose in the form of a furnace lining known as "fettling," and of addi tions to the charge of suitable mill scale From suitable mill scale From 400 to 600 pounds of gray pig iron are gen erally treated in the modern single puddling furnace, the operation lasting about an hour and three-quarters and the consumption of fuel (bituminous coal) amounting to as much as about one ton of coal per ton of iron produced. The operation of pud-dling is very laborious, requiring nearly con-stant stirring of the fluid, and, later, of the d-finid or pasty mass,



nversion of puddled ball to bloom, the arrows indi-cating the direction in which the metal travels

dution and toward the end of the energies, seeks tion of the metallic particles. As might be expected, early efforts were made to devise mechanical means of replacing this excessive and therefore costly manual labor These efforts have consisted generally in the design of mechanical rabbles and of mechanical (revolv-ing, oscillating, rocking) furnaces. None of these appliances, however, proved successful and wrought from



The new puddling furnace shown in cross and longitudinal section

continued to be manufactured practically as it was in the days of Cort. These repeated fullures at cheapening the cost of manufacture of wrought from and at increasing the output of that metal led many to proph mg the output of that metal icu many to proposay that eventually it would be entirely displaced by soft, mild or low carbon steel, which in the Bessemer converter could be produced in enormous quantities and at low cost, unless some ingenious mind solved the problem

Many communers and engineers continue to use or to prescribe wrought from, however, in gather of its much greater cost, which is conclusive evidence that for many purposes it is considered supports to mild steal; and it is also obvious that if the cost of production could be be used much more extensively. There is little doub but that many are waiting for this to come to pass in order to shift from the use of mild steal to that of

wrought from. This willingness to use the more expensive wrought from in preference to steel is due chiefly to its greater weldability, greater restatance to corrosion and greater freedom from brittleness and from binding of joints. freedom from brittleness and from binding of joints. This need of long standing for chapter wrought iron process the small reverberatory pudding frames find by bituminous coal is repisced by a cylindrical revolv ing of-free frames in which charges of pig from welga-ring the coal of the coal of the coal of the coal of the charges of 200 to 500 pounds of the ordinary single pudding formaces. The pig from previously melled in cupie frames to introduced into the frames and at

the proper stage of the operation a suitable amount of scale is added. The arduous work of the puddler who must during the greater part of the puddling operation vigorously stir or rabble the charge, is done away with all together, being replaced by causing the furnace to revolve back and forth, and the liquid from to flow over a dam and the liquid from to now over a dam which divides the furnace longitudinally in two compartments. This repeated flow-ing of the metal over the dam from one compartment into the other causes a thorough mixing of the fron with the oxi dizing sing and therefore a quick refining. When the metal comes to nature, & e, when small solid grains of iron begin to form, the continued motion of the furnace causes the confescence of these grains into one solid mass which is then discharged through an opening in the furnace pro-vided for that purpose.

This mass of iron mixed with sing, gen-

erally known as a puddled ball, is t passed through the rotary squeezer, in which it is compressed and from which it emerges in an elemented form called a

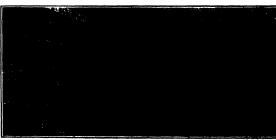
bloom This operation results in a greater compactness of the metal and in elimination of a large excess of sing The puddled bloom may then be subjected to the ordinary treatments generally applied to

wrought from

It would be of little avail to have devised a method
by which to reduce the cost of wrought from and to increase its production unless the quality of this cheaper wrought iron was in no way inferior to the product of the pudding furnace.

An examination of the

new process reveals the fact that the metal is in every way equal to the product of the old pud product of the old pad diing furnace, and some arguments might even be advanced tending to show that it is of su-perior quality. This show that it is of su-perior quality. This product has been ex-haustively tested and it has been found that it could be made to meet all requirements and specifications demanded of surrought less the of wrought iron for the of wrought iron for the various pur poses to which it is applied. It can be produced practi-culty capturies. The e-manganess confeat may be maintained below 0.4 per cent or indeed re-duced to a timos, thus readily mesting the spe-ifections for extra-th-freed armosticities for



The cylindrical, revolving, oil-fired passifing furnace that constitutes the basis of the new way for making wrought from

Inventions New and Interesting

A Department Devoted to Proneer Work in the Various Arts and to Patent News



A half-pound check protector

A Midget Check Protector
WEIGHINO but half a pound, this
check protector can be carried in
carried in
carried in control of the control
of an office deak. In agits of its small
proportions, as coupared with the more
conventional protection, it is claimed to
be fool-prof and to give real protection.
The hard rubber knob, grooved to make
all the necessary flurices, letters and accurate turning easier, has on its coare all the necessary figures, letters and arbitrary marks. Each figure must be set, and at the same time the handles must be squeezed and brought together must be squeezed and prought represent. This movement prints the figure in red lak and shreds the paper, thus prevent ing crusure to the same extrent as any of the more elaborate mechanisms. Feed ing of the check forward for another figure takes place automatically, with the release of the piler handles.

Auxiliary Gas Vaporization on a Large Scale

THOUGH its cycle of operation is rather complex, the gasoline vapor-izer which we illustrate herewith does not seem to present any greatly in-creased probability of getting out of orcreased probability of getting out of ore as compared with the simpler de-triess for adding the carduaretor, and it vices for adding the carduaretor, and it is description. It after its to spention with an extra tube, let into the top of the gazoline tank, open to the all outside, and extending nearly to the bottom of the tank. As the gas flower or is sucked out of the tank, as the gas flower or is sucked out of the tank, as the gas forwer or is sucked out of the tank, as the gas forwer or is sucked out of the tank, as the gas forwer or sucked out of the tank as the gas flower or sucked out of the tank. duced in the bottom of this receptace; and as a result, air enters through the tube described. This air hubbles up through the fluid, and when it reaches the space above the level of the fluid, it carries considerably more gasoline vapor than the air that ordinarily occu-

vapor man the air time transmiss, ples this space.

The gas-laden atmosphere from inside the fuel tank, thus abnormally earliched, is sucked through another tube into the "mixer" and past the "stove," which are



jointly numbered "1" in our view The source minimered "I" in our view "The stove encircles the exhaust pipe, in the familiar fashion. The hot vapor thus provided is led next to the gasoline heater "2" This unit has an inner and an outer compartment. Into the inner one passes the liquid gasoline from the fuel tank or the vacuum tank, as the case tuel tank or the vacuum tank, as the case may be, on its way to the enrichertor Into the outer one flows the hot vapor from the mixer. This causes the gaso-line en route to the carburctor to be materially heated, so that on reaching the carburctor it vaporises more promptly than is usual.

The hot vapor which is responsible for this is not yet through its work. It es from the heater to the distributor "8," which is attached to the curburctor under the butterfly valve When this valve is open, all the hot vapor enters



It looks like a cigar but it smokes like

the carburctor in perfect form for comthe curburetor in periect form for com-bustion and forms part of the mixture fed to the engine When the engine is running idle with the butterfly valve closed, a smaller tube carries the vapor anifold, by-passing the carburctor It is claimed that this arrangement

keeps the engine supplied with such a hot, dry mixture at all times that there is no appreciable dilution of unburned gasoline into the crankcase oil, while the elimination of all raw gasoline in the cylinders eliminates the formation

Straightening Radiator Fins
A UTOMOBILISTS may now provide
themselves with a device for easily
straightening bent radiator fins and
which can be used on any first fin radi
ator. The tool consists of three metal
tech held together by a metal handle
and in use the tech are inserted between
the fins and twisted from site to slote.

Glass for Footballs

A NEW kind of glass, which, if not actually unbreakable, is so tough that it has been blown into a hollow sphere and kicked about as a football without breakage, has been discovered by Dr. Horak, a Casch engineer and inwenter. When used in the form of tum-biers the gluss has successfully with-stood the squirting of cold water immestood the squirting of cold water frame, dinning after being heated to a point where pieces of paper in the tumbier were charred. While the investor does not either that he had noted the eggent has found a very to make it possess the greatest resisting power of any giass so has known. It is admirably suited to the making of thermos bottles, which is so many cases have been to fragitaPlans have been made for applying it to gus masks in order to provide builet to gus marks in order to provide builet protection to the eyes of the wearer, although it will, of course, find its prin ciple use in more ordinary direction, such as for tubleware, bottles, etc.

A Pipe in the Guise of a Cigar THE smoker who prefers a good old A pipe to any other form of mocks, but who has an uneay feeding that it isn't requestible, will perhaps be more at case with the smoke which we illustrate. This is a pipe, made in the form of a clear. It crosses apart in the middle, and the further end is hollow. This is filled with todayen, lighted, explaced, and the with todayen, lighted, explaced, and the parties fast as in the middle of the mi paratus just as he would on a cigar.
There is an air vest at the tip to permit
this, and if he has been so fortunate as
not to have the tobacco go out during
the assembling of the "pipe." he may
have a smoke in the external dress of a sing all the other char-

The Hard-Boiled Hat

COAL trimmers, perhaps, are more ex-Sposed than any other warkers to the hazard of having heavy objects fall upon them from above but in a large variety of trades this risk is present to greater or less degree. An unusually successful effort to achieve protection from this sort of thing is represented by the 'hard-bolled hat' illustrated. This hat is made of the best grade fiber, in numerical. made of the best grade fiber, in numer-ous piles, pressed and cemented together by a patented process. The crown is given a truss shape in order to stand great weight, and when advisable is further reinforced with a steel plate. The entire hat is then covered with the best muslin and treated with a pa preparation making it water and acid-



Simple tool for straightening bent

proof, fire-resistant, non-conductive of electricity, and long-wearing. The lining of the hat is "hammocked" on the head so that it gives perfect comfort to the wearer at the same time preventing the hat from being cramped down over eyes or ears in case of an unusually heavy blow. The hat itself is pliable and will fit a head of any shape. It weighs from five to seven and a half ounces, depend-

sive to seven and a half ourses, depend-ing upon the style, and is comfortable to wear under all conditions. Perhaps the severest test to which it has been put in use came through the case of a miles engineer who was struck on the head by a weight of 12 pounds failing 10 feet. Though he was brought to his knees by the blow and the hat dearted, his bead was not in the least



Hardness tester for rapid and service-able work in the shop

A New Instrument For Testing Hardness
THOSE who have to do with the manufacture of metal parts, especially
metal cutting tools and components of light machinery, know how important is the securing of a definite degree of hardthe seturing or a tenine degree of narro-ness in the material according to its use. One of the disadvantages of the Brinnel instrument is its lack of portability and its unsuitability for dealing with this and fragile articles. The instrument un-der review has lawn designed with a view to overcoming these and other shortcomings of the better known hard-

The tester is designed as a pendulum The tester is troughter to a position, oscillating about its central position. The ball which is of ruby or steel is one millimeter in diameter and is held in a chuck in the center of the instrum it check in the center of the instru-ment. Six screwed weights enable the position of the center of gravity of the instrument to be adjusted to coincide with the center of the millimeter ball. with the center of the millimeter hall. The graduated weight seen in the center can be raised or lowered, enabling the center of gravity of the whole to be brought to a definite distance above or below the center of the ball, the exact distance being shown on a scale. This distance constitutes the pendulum length which for standard tests is one-tenth of a millimeter With this length a single swing on a very hard surface, has a duration of 10 seconds.

a duration of 10 seconds.

It will be observed that at the top of the frame there is a buildle and scale inving set one of the frame there is a buildle and scale inving set on the first the scale of the scale



Safety hat for those who work in da ger from dropping objects



Applying the automatic windshield cleaner to the trolley

from the magnitude of the first swing or from the duration of a definite num-

for iron the duration of a demine num-ber of swings.

In the scale test, the amplitude of the first oscillation may be read off on the scale and the position of the bubble denoting the work done by the ball on the specimen, is a direct indication of its bardness. For instance, 97 is glass-bard, hard steel reads 88, brass 14 and lead 0. The effect of tilting the 15 and tend 0 The effect of tilting the instru ment is to elugate the indentition unde by the bull when it is placed on the specimen and the distance it rolls hack along the groove so formed is indicated by the scale from which the hardness is

A time test is more usual for it gives A time test is more usual for it gives uniform and concordant results without the necessity of accurate leveling or extreme susoithness of surface. It in volves a "time hardness number," which is the time in seconds (stop watch essen tial) taken in making ten single swings. For material glass-hard the time is 100 seconds, soft steel 20 to 40 and so on down to lead 8.

To take this test the instrument is set

upon the specimen with th e nea the center, or graduation 50, and caused to oscillate through a small are and the swinging time taken as before stated.
The time of the oscillations is, within
limits independent of the magnitude

The overall size of the instrument is 12 inches and the weight either two or four kilograms. The former has a ruby hall and is used for delicate work, the latter with a steel ball is used for gen eral workshop purposes. The apan for clear working is six inches Articles of an awkward shape can be supported in a ball vise, while flat specimens are simply dealt with on the leveling table



The device that whistles a warning of

Clear Vision Ahead for the Motorman

UTOMATIC windshield cleaners were first devised for use on automobiles. A harst devised for use on autospoules, the drivers of which must be able to see where they are going Vehicles that run on tracks can be run in comparative safety, even when the man in control safety, even when the man in control cannot see where he is going, but white it comes to trolleys operated in busy thoroughfares, it is necessary for the safety of others that he see when it is proper for him to go thers. The Cleve-land Street Ruilway Company was the first traction interest to adopt the win dow cleaner illustrated, giving the motorman a clear view of the road shead of the car no matter what the ahead of the car no matter what the weather. Louisville has followed suit, and the device looks like one that meris general introduction. As the photograph indicates, a small electric motor is pro-vided, which keeps the wiping element in constant motion, requiring no further attention from the motorman than the initial throwing of a switch

For Hanging Shafts

RECENTLY there has come on the market a pressed steel shafting hanger of very pleusing lines and good engineering construction. It is of the engineering construction. It is of the four-point set screw type, and has a swing yoke which readily permits the removal of shaft or learings. The main frame is of two stampings placed face to face, with in turned flanges extending the entire length of the leg flanges provide unusual strength Then The cross-brace is integral with rigidity the legs themselves. All nuts, bolts and set screws are of standard sizes. The general appearance is very good, with smooth frame and rounded surfaces that eliminate dust pockets and projecting



An interesting shaft-hanger of

An Audible Gas Signal WE have more than once described devices intended to remind the for-

V V devices intended to remind the forgetful motorist that his gasoline supply is approaching extinction. The latest thing of the sort actually shouts the warning at him. It is of the general warning at him. It is of the general type, aiready noted, having a long and a short upright tube in the bottom of the tank, with gas flowing normally out of the long tube, until the level of the ling tube, until the level of the flow out of the short one. But it departs from the usual standard of this parts from the usual standard of this type, both in arrangement and in moduse openedd. The principal point of dif-table in inverted as pletrard. There is suction on the long tube, even after gas cause to flow through it, and this suc-cura to flow through it, and this suc-cura to flow through it. The sheat car begins to whistle at him, the absent-ing the control of the control of the con-landed motorial looks for the familiar in motoring code means "Gas sold heres."

An Efficient Scarifier
A MONG the season's novettee is a
new piece of paving equipment put
out by a prominent Cleveland concern out by a prominent Claveland concerns that specializes in apparatus for the road contractor. As all instanted, it is the property of the road contractor is all instanted, it is the last not found particularly useful in securifying subgrades preliminary to method to the road of the partiments. At carries are teen, and equipment furnished with the machine includes two complete sets of these teeth, plus one special manganese-steel tooth for extra heavy work. The ma-chine weights about 1300 pounds, and is furnished for tractor or team hitch.



Another tool for wrecking reads in preparation for repaying

The Spreading of Liquids
A N interesting paper by W. D. Herkins and A. Feldman on this sub-A kins and A. Feldman on this sub-plect appears in the Journal of the Amer-ican Chemical Boolety for December, 1962. The apprending of liquids both on and the relations worked out between and the relations worked out between the coefficient of spreading and the in-terfacial and surface tensions. The arisus terms used in the theoretical discussion are defend, experimental methods are described, and the results methods are described, and the results of numerous determinations given. Those interested will do well to consult the original paper, which is not of such sort as to be effectively abstracted.

A Problem in Thermometry

A Problem in Thermometry
PIMMFRATURE indicated by a therI mometer in a medium whose own
temperature is changing, presents a lag.
Mr. B. P. Owen of the University of
tetermining this lag, taking into actetermining this lag, taking into
activities are obtained for
spherical and cylindrical bulles, with
surface conductivity both infinite and
finite in both cases. The mean lag in all cases takes the form of a series, of
which only the first term has numerical
significances.

A Signalling Window for Closed Cars



Novel type of window that makes

A Dubuque lawator, Mr W. A. Erner, points out that the closed car is still a long way behind its open bother in the degree of freedom with which its driver ons signal by hand. It's all way well to signal inside the car and trust to the man behind to see the signal through the rear whidow, but what whea the rear sets is occupied? What, in say the rest set is complete. With the sevent, when the driver behind goes his court and states fiatly that he was writing, but saw no head signal 18 of signaling window for closed care. It opens with a push—a newer couch, in fact, of the hand that moves outward to a pull on a lever or a cut or a strap—or saysting else that the owner profess, for that nattern or that the owner profess, for that nattern or the court of the

A New Role for the Clutch
COMPELLED to attack a difficult job
cin its own factory, a Wisconsin concern making disk clutches discovered a new application of their own pr They had to change the location of some of their machines in order to expedite production, and they found the usual difficulties in the installation of counterdifficulties in the installation of counter-shafts. It was suggested that they in-stall one of their own clutches on each taken, and drive a bactory of eight inthes states, and drive a bactory of eight inthes eight countershafts and eight cross-belts being discarded, and at the same time the fraying of belt edges by beit shiftness being absolished for all time. It is suggested that this new applica-tion of the clutch idea will enable every tion of the clutch idea will enable every

tion of the clutch idea will enable every manufacture to moderains his equip-ment and cut out his countershaft troubles. The clutch which served so well in the present instance is illus-trated. It is a twin-disk affair, so de-signed that the lifting of one pin per-mits adjustment up to 0.05 inch, no tools being required. It gives a positive ex-gagement and does not heat.





The Electric Cream-Whipper

A MONG the special jobs about the A house for which a special machine is now offered is the whipping of the cream for the morning cereal or the evening pudding. The entire apparatus as illustrated, motor and beater, though as illustrated, motor and beater, though purchasable separately normally comes in a single unit from the manufacturer, in a single unit from the manufacturer, but, of course, the motor is available for other work. The labor of whipping cream is considerable, in unfavorable weather, and even under the best of conditions, it is a little job which the house-wife will no doubt be glad to get done for her, mechanically

Filling the Radiator

WiTH the aid of this neatly designed galvanised metal can or bucket. W galvanised morial can or bucket, with a wire reinforcement around the top and squipped with two metul han does, the funnel, splank and drip have been eliminated in the filling of radia fore. Note particularly the shape of the spout, curved so as to fit in the radiator popular, ellinianting splanking and lesking. The outlet opening is large and with rull weight of varies behind it, these radiator diletes are exceptionally decidence of the control of t

An Efficient Hand Lifting

An Emicient Hand Lifting Appliance
An efficient form of hand lifting-gear hoist is adaptable, the absence of a form rendering it equally suitable for a lift of two feet or 100 feet It can be used on a 5h for warehouse and garage work.

on a jih for warehouse and garage wors, or can be fitted on hoard a small craft as a capetan for hauling purposes. The appliance has a capacity of one ton. An internal gear is mounted on an eccentric aphide, to which a handle is produced. the gear is caused to oscillate in such a manager that the teeth of the internal wheel roll round those of a bevel pinion



tackle for lifting join, with a wide range of application

mounted in the body of the hoist. The internal bevel has one tooth more than the fixed pinies and is thus enabled during one oscillation to advance one tooth, while the chain wheel sprocket, being cast integral with it, is revolved

being cast integral with it, is revolved and the load raised.

Braking and lowering are controlled by a drum and pawl mechanism, the drum being supported in the front bear-ing, in which it is free to revolve, but

ing, in which it is free to revove, is held in position by pins.
Directly the handle is released, the pawl engages with the teath of the drum and tends to rotate it against the present the analysis of the drum periphery and tends to rotate it against the pressure transmitted to the drum periphery by the load. This friction is quite sufficient to prevent the handle from re-resting of its own accord, but the application of a few pounds pressure is abough to rotate the drum it will thus be evident that the holst cannot overrun when the handle is released during hoist-

Drill and Gas Engine in a Single Unit

HERETOFORE, all power drills, of whatever 13 pe, have been limited in their application to the work by the length of an air hose or of an electric wire Power for either of these methods must be supplied by an auxiliary power equipment which, on account of size and

equipment which, on account of size and weight, cannot be circuply transported, nor located sufficiently hear the work to do now than other chirt of the control of the chiral property is no spring or other yielding member No inlet or exhaust valves are neces-sary, the rotary valve principle being used, with the revolving mass of the



Easy filling of the radiator, without slopping, is achieved with this spe-cially designed backet

fly wheel opening and closing the ports in the cylinder at the proper moments. The down or power stroke of the ham rise down or power stroke of the main mer piston is made with some 900 pounds of explosive force from the gaseline be-hind it. The flywheel returns the ham-mer piston on the upward or compresmer piston on the upward or compression stroke Approximately 1800 impacts are struck per minute by this single-cylindered bit of impanuity Carburetion is by means of a gasoline-mixing valve which permits the engine to work at any angle While the engineto work at any angle While the engine-drill runs at full speed, the operator shifts it from one position to another and to any desired unfie without affect-ing the operation. A targic spin of the statestry, in the collect weather "full 'con-sistently, in the collect weather "in the lock like one of those things in conne-tion with which the much-abjused word "evolutionary" may fairly be used

Another Phonegraph-Record Repeater

THE latest and most simply con-structed repeater for playing phono-graph records has been just patented and is now ready for distribution. This device after several experiments,

device after several experiments, has been proven not only to be practical but to be easily handled by children. This repeating device for the phonograph needs no adjusting whatever it just ails in the center of the record over the peg, and does not touch the playing surface nor will it injure in any way the reproducer or needle. Its action is instantaneous with no break or pause between the end of one run and the commencement of the next. As the needle at the end of the sound



This portable drill carries its own gas engine, and is tied down by no air

box reaches the end of the record, the tone arm is automatically carried (quick as a flash) and gently placed at the

starting point

This device is made from sheet steel
punchings, consisting of flat base plate,
a movable arm which picks the tone arm up at the needle, operating on a can, which is automatically returned to its original position by means of a coll spring. It is handy and convenient to apply and to use and its total weight is less than one ounce.

Permanent Automobile License

Plates

A NNUALLY in the United States
A 20,000,000 automobile license plates
go into the discard and this means that
twenty millions more must be made The
cost of the making is borne, in the last
annipsis by the motorist To obviste
this situation, James E. Reliers of Los
Anneles by Reliers of Los this situation, James E. Bellers of 1,000 Angeles has designed a plate which will be permanent, so that the motorist will always have the same serial number When the plate is first stamped it re-When the plate is first stamped it re-ceives three extra impressions, being in the nature of depressions deep enough to counterwink even with the surface the additional smaller plates bearing the date which is subject to change at the beginning of each year. The depression at the left of the serial number is di-pusational to match a small plate here. mendoned to match a small plute bear-ing the name of the State and the year Above and below the number are smaller depressions for the application of whatever data the owner desires, such as his name and hometown, or his club If desired, these spaces may be left blank. The smaller plates are attached securely and quickly by means of small screws

A Clean-Cut Gas-Tank Filling Fing
This recessity of a locked filling plus
I for the motorcur is an admission that
then are few things connected with the
nutomobile, whether valuable or of small



The newest phonograph repeater

value, that are not the object of petty theft. Even gazoline is siphoned from the tank and the unsuspecting motorist, returning at night, is faced with the un-

precuring at night, is faced with the un-pleasant discovery that his tank, which he thought was amply full has run dry. As gaodine is not a particularly valuable commodity, the addition of a lock to the filler plug acts in practiculty all cases as sufficient deterrent to send the thief to the next unguarded car for his pliftrage In the case of patents granted to S S Soiles of Savannah, Ga., this lock takes on a particularly neat as well as efficient form. The lock, which is of the type having a fluted key is entirely contained within the removable plug and the actual locking member or lug is placed in the plug in such a way that it is as inaccessible for tampering as is a similar type of lock tampering as is a similar type of lock when mongted on a metal door. When the key is inserted and turned the plag, which includes the lock mechanism in remarkably small space, is removed. There is no other handle for this purpose than the inserted key so that when the filling has been completed the plug reinserted and the key removed, the lock is flush with the surface of the tank, leaving no projections for prving At the bottom of the mining memoer, when is tubular and about four inches in depth is placed a course grating which prevents large particles of matter from getting into the tank when it is open for

Window Washing From Within A SEAT for which many housekeepers will not accept even a free ticket is that upon an upstairs window ledge is that upon an upstairs window ledge fear of failing makes unpleasant the task of cleaning the pock marks of dust and soot, spotted by rain, from the out-sides of the bedroom window panes. If the housewife will invest in a "third arm,' however, the cleaning can be done from within the house. A long handle has at its end an elbow turned at right angles and to be used facing the glass. angles and to be used facing the glasse.
Tipping the "fore arm" is the "hand,"
which grasps a wet cloth, chamois,
sponge or rubber Afterward, a dry
cloth is handed to this ever-ready model



Cleaning the outsides of those upstairs windows, without sitting out



The "B" battery that stands up in-stead of lying down, thereby saving much space

servant, for the task of polishing the pane Nor is this the only unpleasant house-cleaning job that the "third arm" will do When the now-clean windows "show up" the dust and grime upon the wall paper a clean cloth can be used in the same tool for wiping down the walls,

Gaskets for the Piston

You have gaskets in numerous places don might leak out in their abpression night loak out in their ab-sence, you have packing in your pump and ahims here and there and every where else, but your platon rings are left to make a tight fit as best they can, without any external aid. In the car of the future it may be different, we have seen at least two proposals to make it so. One of them consists in a scale, listed without the list of the con-lets. cork-lined piston ring, the cork lining performing approximately the service of a gasket This manufacturer makes you buy the rings to get the guskets another is more liberal, and sells asbes-tos piston seals alone, to be fitted to whatever rings you happen to have on your pistons. The claim is made in both cases that gasoline leaks and oil pumping are much more effectively checked than by plain rings of any design, and that curbon is thereby reduced and power increased. We tried the cork
specimens in the editorial Tin Lissie. and found that at least, they gave n bad effects whatever, on the extent of their good effects we were not certain, since the car was in admirable condition when they went on it.



The machine that balances moving parts at preduction speed

A "B" Battery That Takes Up Less Space

ENTHURIANTIC—this is the word ENTHUSIASTIC—this is the word employed by the makers of a new and larger type of "B" battery, to describe the reception given the article by the radio audience The new battery scribe the reception given the article by the radio audience. The new battery may be called a vertical battery, stand-ing on end and having its terminals on top just like the regulation dry battery It is four inches by three in cross-nec tion, 6% in these high, and occupies less than half the ground space taken by the usual "B" battery of equal capacity
Its voltage is 22.5. It includes in its construction the features of seamless drawn sine cans, individual cell insula-tion, thorough moisture-proofing and im tion, thorough moisture-proofing and im-pruved series connections. Its space-saving advantages are particularly noticeable when a number of units are bound together in compact sets with dry "A" batteries, and used with port able sets. Also for loud-speakers, where four or more "H" batteries are used in series to produce a high potential, the

A Precision Balancing Machine THE distration shows a balancing machine recently placed on the market, applying the principles of dynamic and static balancing invented by Dr B L. Newkirk of Schenectady, so that it is possible to obtain complete dynamic



A very handy tire pump operating from the engine through a rear-wheel hab

carries a special type of headstock and de rollers to support the work. adjustable rollers to support the work. By the form and location of the springs, a free vertical vibration of the frame may take place about the pivot springs as a fulcrum point. All revolving parts, including the rollers which support the work, are mounted on ball bearings. A speed of rotation above the "critical speed" of the frame is first used, and the driving power is then disengaged, permitting a gradual diminution of speed down to and through the free

The pump itself is clamped to the running board. The arm leading from the pump to the hub is adjustable to meet the differences in running board design, the short arm that forms the driving connection has to be supplied in size and shape fitting the hub of the given car The pump can be used on 80 per cent of the automobiles new in use. It is clamped to the hub of one of the rear wheels and then this rear wheel is facked up and the engine started.



Asbestos or cork linings for piston rings are claimed to cure many of the

and static baluncing by two single cor-rections, individually measured and lo-cated near the ends of the body When duplicate parts are to be balanced in production, great rapidity can be attained as static balancing is rendered unnecessary and the operator, who need not be highly skilled, has only a few

simplified positive steps to perform
A spring-mounted and pivoted fram

critical speed of the frame. From the observation on the dial indicator, mounted part way up on the column at the left, the amount of the required correction is determined.

A disk at the left of the revolving A disk at the left of the revolving parts carries a standardised 10-once weight, adjustable radially by means of a vernier reading to 001 inch. These parts are exactly butanced when the weight is at zero. The disk is adjust able to any angle by reference to a protractor disk.

protractor dial.

With the correction thus arbitrarily applied the machine is again speeded up and allowed to pass through the critical speed as before. The second amplitude speed as before. The second amplitude in this process bears a relation to the first amplitude dependent on the angle between the point of application and the point required. After determining and setting off this angle, a third run will check the result. The machine is universally adapted to a wife variety of work, including balancing crank-shafts, wheels, rotors, pulleys, and other revolving parts. It will receive bodies of the property of t

Pump Operated From Rear-Wheel

THIS novel tire pump is operated from the hub of the rear wheel and can pump up a tire in a few minutes

Accurate Tire Inflation

ANEW the inflating device resembles the signal apparatus on the bridge of a ship. On top of a metal standard there is an air gage 8½ inches in diameter, equipped with an indicator attached to a metal handle. By means of the handle, the indicator is placed at the number of pounds inflation desired by the motorist, in the same manner that signuls are given to the engine room from a shin's bridge. As soon as the indicator is placed at any inflation point, the air is released into the tire. When the air is automatically cut off from the

The air inflator consists of a reducine air valve working in conjunction with an air gage. The indicator may be set for any pressure, from that required by a blcycle to that of a truck tire. It registers the pressure from the time the hose is applied to full inflation, eliminat-ing the necessity of one or several tests with a small hand gage.

When not be the desired presence, this sirestend stope the passage of all as seen as that figure is reached in the

The Service of the Chemist

A Department Devoted to Progress and Achievement in the Field of Applied Chemistry eted by ISMAR GINSBERG, Chemical Engineer

New Source of Nitrates in South Africa A COORDING to the South African

A Journal of Industries, a new source of nitrates has been located on the Matsup Pan, situated in the Hague district. This Pan is remarkable in that it con sists of an underground store of nitrate-bearing brine. Analyses of the brine from several boreboles showed that over 4.5 tons of actual nitrates, mostly sodium

Catalysts in Glass Making

Catalysts in Glass Making
LUGRINS and antimony have the
curious property of altering the thermal expansion of glasses to which they
are added They appear to act in a
catalytic manner as no fluorine remains
in the faished glass, and although about
1 per cent of authoraty my reveals, it
per cent of authoraty my reveals,
it considered to the control of the control
comments. The control of the control
comments with the control of the control
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comments. bot glass during working, is dissolved from it by boiling water and even more so by sodium tartrate and hydrochloric acid.—Chemiker Zeitung, 1923, page 146.

New Alloy for Grate Bars

THE burning out of grate bars, both in the industrial boiler as well as in the estic steam heating furnace, is a rather common occurrence In Gring has been a source of serious inconven has been a source of serious inconven lence A new alloy, a special variety of cast iron, has been devised which ap-pears to evercome most of the difficulties. The new alloy is a special form of puri-fied cast iron with a much higher melt ing point and tensile strongth. Its life is claimed to be from three to ten times that of ordinary cast iron and it pours without difficulty and does not crack The cost is only 50 per cent higher than that of ordinary east iron.—Jour Soc. Chem Ind., 1928, page 375.

Paper from Banana Refuse

A GOOD paper can be made from banana refuse, according to the World's Paper Trada Review The trash or refuse, consisting of the stems and leaves of banana trees from which the saves of banana trees from which the fruit has been cut, is passed through crushing rolls, which produces a mash in which the moisture has been reduced from 90 to 55-75 per cent. The liquid is drained off and the trash is passed through a breaking or pulping machine where it is reduced to a pulp. The pulp where it is reduced to a pulp. The pulp and Jules from the mechine are then placed in a boiler, water is added and for the pulp of the pulp of the pulp of the form to fire attemphere to a period of three to six hours. The centents of the boiler are then transferred to a bester, where the restinous and gummy matters, where the restinous and gummy matters, which have been set rever the substitution of the which have been set rever deal of any as powder or pellets by a current of water. The removal of its filecus material from the beater completes the process, in which no channel is used.

Subtle Liquer for Building Parpones

A NOTERIES to not the waste liquors and hourseld from sulfite cultulose much hourseld from sulfite cultulose mode for sulfite cultulose mode for sulfite for sulf

hydrated lime and about 2 per cent of the waste liquors is added. About 5 per cent of technical hydrochloric acid is added to the mixture. Other acids may be used as well. In this manner e is formed so large a quantity of there is formed so large a quantity of hydrochloricallicic and that a solid, absolutely water-resistant atone is pro-duced. When the process is altered in certain respects a product is obtained which may be used to good advantage as a substitute for fair roofing. This prod-uct is more lasting than the ordinary tar-roofing and furtherwise it does not proroofing and furthermore it does not nossess the well-known advantages of the latter. By using this material the build ings may be finished off both inside and outside with the same building material and consequently the labor involved in using plaster and similar finishing mais is considerably reduced. Suifit cellulose waste liquors can also be used to good advantage in manufacturing in sulating sheets and plates, flower pots, as well as many articles made heretofore

War Gases Cure Disease

THE Chemical Warfare Service of the United States Army has been conducting tests at the Edgewood Arsenal to determine the possibility of using war gases, originally intended to kill, to cure disease The gases have been recommended as a cure for the diseases influence, tuberculosis, parests and other afflictions. Weak concentrations of chlorannertons. Weak concentrations of enfor-ine gas introduced into the rooms occu-pled by those exposed have been asserted to prevent the spread of grip and in fluenza epidemics. Mustard gas has been demonstrated as a specific against tuber-Tests have been made with culosts. Tests have been made with guinen jags inoculated with tuberculosis germs and a concentration of mustard gas, and it was found that the animals did not contract the disease. The sub-stance lewisite was experimented with and it was found that this is a remedy ot a cure for paresis and locomotor e could be used to prevent or cur colds, influenza or pneumonia was acci-dentally discovered at the Edgewood Ar-It was remarked that cases of nonia or influenza did not occur in the laboratory where chlorine was being to 20 per cent of others on duty at the arsenal were victims Investigation showed that in the rooms where the chlorine gas was being made there was a slight leakage of chlorine, just enough to act as a germicidal

Double Window Panes

DOUBLE window panes, separated by a distance of two millimeters and joined together by a specially designed and patented melting process, so that no moisture or dust can penetrate between the place of ordinary double windows, according to a Swedish process. The heat insulation is perfect under these

New Alloys

New Alloys

NEW alloys, which are especially well
suited for making propeller shafts,
are described in the German Journal
Georetesfeles, 1923, No. 3, page 84. These
alloys are made by adding bronze or
vanadium brass with copper, aluminum and nickel or with copper, aluminum

and iron, or with copper, aluminum and mangazese Vanadium appears to com-bine more easily with iron, nickel or se than directly with copper of zine, so that fron, nickel and manganese act as so-called intermediate media Vanadium can also be added to the metallic composition in the form of ferro-vanudium. When this is done, the cost of the alloy is reduced.

Volomite, a Substitute for the Industrial Diamond

THE industrial dismond, the black THE industrial diamond, the black bort, is replaced to good advantage by the theaper volonite, according to a of the Prussian Geological Institute While the product volonite is not of maximum hardness, nevertheless it has been reported that it gives absolutely satisfactory results for boring rock of medium hardness. The reader is re-ferred to the original article for further

Tallow Trees

IN Texas there is being grown a tree which is quite new to the United States. This is the Japanese tallow States. This is the Japanese tallow tree Trees of this species bear nuts that contain a rich tallow like oil. This oll has been found valuable in the manu facture of high-grade varnishes. It has been found that the climatic and soil conditions are well adapted to the growth of this tree in certain parts of

New Rust-Preventive Agent

A (YS)RDING to the Funches in Tech

A nik and Writnhaft a part of the

Vossiche Ecitum, February 23, 1923, a
new rust-preventive agent or rather

process has been developed which is particularly useful in protecting vehicles and vessels. The process consists in prothe metal. This film of cadmium has a thickness of from 0.002 to 0.001 of a millimeter and is produced in the elec-trical way by dipping the metal into a solution of a cadmium sait. The coated metal part is then placed in an annealing furnace, where it is heated to a glowing heat for a period of two to three lours and in this way the deposited film is made to alloy with the underlying metal. The surface conting that is produced in this manner is much more durduced in this manner is much more dur-able than the ordinary coatings produced by galvanizing with nickel, etc. The color of the treated part resembles that of a silver-plated article

Blotting Paper from Wood Pulp

BLOTTING paper is generally made from rag pulp, and it is accordingly a restly important achievement that has been recorded in the daily papers that a Canadian pulp mill has succeeded in manufacturing a very good grade of blot ting paper from ordinary wood pulp ting paper from ordinary wood pulp.

Differentiating Hemp from Flax II. As so so of those products that is subject to a great deal of adulteration, due to the fact that its supply is limited and its price is high One of the substances used in adulterating flax is hemp, and this practice has been causing considerable trouble, due to the differentiating between the two Bern.

Cotton is also used to adulterate flax. but it is a comparatively easy matter to detect the presence of the cotton fiber mixed with the linen fiber under the

The Linen Research Institute land has devised a simple test whereby It is a comparatively east matter of the first state of the first flax or linen fiber on a left handed spiral If a thread is frayed out and wetted it will tend to curl up either in the same direction as the hands of a clock if it is hemp, or against the clock if it is flax If both motions are found in the same material the secoiled lines is bound to be a mixture.

Making Linen Bags More Durable

Links bugs, especially those that are Lined for shipping fertilizers, are ren dered more durable by dipping them into a solution of potassium silicate or sodium silicate (water glass) They are then wrung out well and dried. The solutions of the chemicals must be rather dilute For further details, see the reports the Academie d'Agriculture of Paris,

New Mercury Deposit

NEW vein of quickstiver said to be seven miles long and to vary in width from two to six feet has been covered near Kita Uonome in the Goto Archipelago The ore contains 18 per cent mercury, and preliminary trials indicute that the vein increases in thick-ness with depth This vein is important as none of the veins so far discovered in Japan are suitable for working -- United States Commerce Reports, Feb. 12, 1923.

Lignite Char

THE United States Bureau of Mines has made an exhaustive investigation into a process for utilizing lignite coal As is well known, there are very large deposits of lignite coal in the states of North Dakota and Texas, as well as in Canada These deposits are not being worked at the present time, but they represent potential sources of fuel which or later have to be resorte to as coal becomes scarcer The Govern ment has realized the possibilities of lig-nite coal, and experiments have been

It can be utilized as a general fuel.

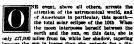
The great trouble with lignite is that the coul contains a large amount of moisture and an appreciable amount of ash The fusion temperature of the ash is comparatively low, which makes high rates of combustion difficult and requires larger grate areas and furnace volume than with higher grade coals. In other words, the coal has to be improved first before it is possible to use it in the ordinary stove or furnace

The lignite is accordingly charred The moisture and volatile matter are driven off and a fuel is obtained which resem bles anthracite coal except that it is softer and contains a little more volatile matter. This makes it coster to kindle out 2.5 tons of raw lignite coal will about 2.5 tons of raw lightle coat with produce one ton of char, which has a heating value of approximately 12,000 Btu's per pound. The molature is very low, and the char can be stored without any danger of fire or degradation in a

The Heavens in September, 1923

Some Details About the Total Solar Eclipse of the 10th

By Professor Henry Norris Russell, Ph. D.



only 2.7/4.00 miles from us, while her shadow, ispering because the sum is larger than hes, extends for a dis-ture of 284.000 miles, reaching 7000 miles beyond the certification of the certification of the certification of the certification of the interest field. At this distance from the point, the shadow cose is 00 miles in distance from the point, the shadow cose is 00 miles in distance from the point, the shadow cose is 00 miles in distance from the point, the shadow cose is 00 miles in distance from the point, the shadow cose is 00 miles in distance from the point, the shadow cose is 00 miles in distance from the point, the shadow cose is 00 miles in distance from the point, the shadow cose is 00 miles in distance from the point, the shadow cose is 00 miles in distance from the miles in distance in the shadow cose is 00 miles in distance from the miles of 00 miles, which is the shadow cose is 00 miles in distance from the miles of 00 miles, which is not only the cost of 00 miles in distance from the miles of 00 miles, which is not only the cost of 00 miles in distance from the miles of 00 miles, which is not only the cost of 00 miles in distance from the miles of 00 miles, which is not only the cost of 00 miles in distance from the miles of 00 miles, which is not only the cost of 00 miles in distance from the miles of 00 miles, which is not only the cost of 00 miles in distance from the miles of 00 miles, which is not only the cost of 00 miles in distance from the miles of 00 miles in distance from the miles of 00 miles in distance from the miles of 00 miles of 00 miles in distance from the miles of 00 miles of 00 miles in distance from the miles of 00 miles of 00 miles in distance from the miles of 00 miles of where the sunlight was dimmed, but not wholly cut off. This spot would sweep eastward across the earth's disk at a speed equal to that of the moon's orbital motion—about 2200 miles per hour But as it moved, our imaginary Lunarian would see the earth rotating, carrying continents and oceans eastward

carrying continents and occans eastward at a speed of a thousand miles per hour on the ecuator, or from seven to eight hundred miles per hour in the latitude of the United States. The moon's shadow hundred nites per hour in the latitude or the United States. The moon's shadow accordingly overtakes the American con tinent at the rate of some 1500 miles per hour, and takes three minutes and a limit to move a distance equal to its own diameter A point on the central line of the shadow track will therefore be in darkness for three minutes and a half and one could go 20 miles or so on either side without finding the duration of total ity much diminished. Since the sun s rays strike the earth's surface somewhat obliquely the full width of the shade track is a little over a hundred miles. At the edge of this belt the sun will be hidden the edge of this belt the sun will be hidden for but a moment, while points beyond will never quite lose the sunlight For 2000 miles on each side of the central track, however, the moon will cut off more or less sunlight, and a partial eclipse of greater or less magnitude, will be ob-servable throughout the whole of North

The shadow track, beginning in the The sondow track, beginning in the ocean south of Kamschatka, sweeps over the Pacific, just missing the Alcutian Islanda, and first reaches land in California Curtously enough, the limit of totality just grasses the coast for nearly totality just grasses the const for nearly 200 miles. A few projecting publish near Santa Barbara will be in derkness, but some constant Barbara will be in derkness, but near will have to write the simals ordinors or size no further south. San Disgo one or the nemitates of derkness, but the central line comes ashore nearly 50 ments there multited of artiferate, but the central line comes ashore nearly 50 ments of the size of the central line comes ashore nearly 50 ments of the size of the central line comes ashore nearly 50 ments of the central line comes ashore nearly 50 ments of the central line comes ashore nearly 50 ments of the central line comes ashore Central line of the central line of the

The Eclipse in the United States

Throughout the Pacific and southwestern States the partial eclipse will be a large one, three-quarters or more of the sun's diameter being hidden. Chicago will more of the sun's diameter being hidden. Chicago will see the sun half hidden, and New York will have a somewhat smaller clipse. The local time of the middle of the cellipse suries from shortly after noon (Pacific Time) at Neattle and 1 P M at San Diego to 3.30 (Central Time) at Chicago and 4.40 (Reastern Time) at New York—the differences arising mainly from dif-ferences in longitude. To these hours must still be added the change to Daylight Saving Time where this

Is kept.

The eclipse will be interesting to watch anywhere in America. But its main interest centers of course in the narrow zone of totality. The spectacle there will be fine enough, saids from its scientific interest. to repay any traveler for a long journey. The weird colors that bathe the landscape when only the light from the sun's edge remains; the advance of the moon's shadow, dark as the blackest storm, and traveling with the speed of a cannon ball, the sudden darkening of the whole landecape, almost as rapid at the last as a train entering a tunnel; the appearance of the stars,

train entering a time of; the appearance of the stars, and of the corross enterleng the collused sun, and of the scarles promissones, clues to the mostle sedge; and the stars between the stars of the corross. The star scarce is the scarce in the scarce i

t. 14.
21 At 9% o'clock: Supt. 30.
iven are in Standard Time. When local sur

ectipee, and the long line of bright bodies, strung out on the cellptic, will be a noteworthy sight. At the present time of promoned sun-spot infinitions, we may santicipate a relatively faint coreas, with pro-nounced polar rays and long streamers in the direction of the sun's squator. For the same reason, the prem-inence are not littled to be consiperconst-through pre-inence are not littled to be consiperconst-through pre-

The Astronomer and the Eclipse

The Astronomer and the Beligue
The astronomer, of course, will go to observe the
eclipse rather than to see 1t—and the man who gate
10 or 15 seconds to book at the aights will be lacky.
A host of observations can be made, and most of them
will be attempted by one or another of the parties,
the property of the start around the sense of the start of the
more final confirmation of the "Startets effect." The
polarization of the coronal light will be investigated,
and its beat measured. Perhaps the most importance
observations of all will be with the spectroscope—photempted the parties of the startet of the size o

that of the corons during totality, to secure a more information as possible about the only bright lines in its spectrum, which are still

more information as possible about the estimated bright lines in its spectrus, which are still without without bright lines in its spectrus, which are still without wasterney to be an extra the still be about the still be an extra the still be as the still be an extra the still be as the still

The Planets

The remarkable display during the eclipse is necessarily matched by a corresponding dearth of planets in the nocturnal skies. Mercury is an ever for most of the month, and may be fairly well seen about the time of his elongation, on the 2nd, when he is 27 degrees from the sun, and sets at 7.30 P M.—though he is too far south of the sun to be con-

Venus is a morning start at the month's Venus is a moraing start at the month's oeginning, but passes through inferior con-junction on the 10th, only a few hours before the eclipse. She can hardly be seen under ordinary circumstances, for even at the end of the month she is but

before the selipse. She can hardly be seen under ordinary decumstances, for some control of the seen o

The Motor-Driven Commercial Vehicle

IN MAJOR VIOTOR W PAGE M. S. A. M.

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles

A New Motor Pick-Up Street
Sweeper
In perfecting the present mechanically
successful sweeper the engineers IN parinching the present mechanically successful sweeper the engineers until successful sweeper the engineers until the manufacture of the surface of the s

that works in and out with the curb line, independently of the driver The ine, independently of the driver the earlier types of sweeper did not have this provision for cleaning gatters with the result that additional men were re-quired to complete regular cleaning equipment. Today with increased traffic pushing more refuse from the center of the street toward the gutters a greater need was created for a special attach need for cleaning the gutter. The gutter broom attachment was developed to take care of this need. It not only cleans the gutters more efficiently but with a

great saving of labor cost as well.

The design of the large rear broom is such that wear automatically shortens the distance between the broom and conveyor Fouling of the conveyor through breakage of the shear pins is prevented by the broom's coming to a prevented by the broom's coming to a complete stop. The conveyor is of large capacity and of the non-clogging type. Heavy sweepings are claimed not to choke the conveyor. The removable choks the conveyor The removable bottom, in itself a feature, in easily replaced. Only six drive chains are employed on the entire machine, including the conveyor The sweeper can be operated while the machine is at a standarill. Mechanical parts are readily accessible. The working speed is nine niles per hour

The new sweeper is of the four-wheel type and employs a speed wagon power plant of standard construction with right-hand drive and self-starter It is n machine with all levers so arranged that the operator has complete and convenient control without leaving and convenient control without leaving his seat. The rear axis of the speed-wagen is moved forward and converted into a jack shaft, whence the drive is through roller chains to each rear An auxiliary transmission is wheel. An auxiliary transmission is mounted between the transmission and differential to give power for operating conveyor, large broom, gutter broom and water pump. The large broom, of steel or bamboo, is driven by a roller chain on cut sitsel sprockets. This rear broom is quickly adjusted to the roads and is automatic in operation after adjustment, following the pavement with just enough pressure to do good work

enough pressure to do good work
The conveyor is driven by roller chain
on cut steel sprockets. The conveyor
itself is of all-steel construction with
removable bottom Rubber squeegees mounted on extra carbon steel angles form the flights. An efficient anticlogging device takes all undue strain off the conveying mechanism and allows piled material to be swept without clogding the conveyor. The hopper or dirt receptacle is also of all-steel construction. The gutter broom is driven through a universal Joint assembly from auxiliary transmission. The broom is steel fiber filling, built up to 42 inches diameter in six segments that are easily and quickly changed when broom is worn out. The working range is seven

The water sprinkling system consists a 150-gallon galvanized iron tank with brass strainers at intake and out-let. Water runs by gravity to rotary gear Demming bruss pump which forces water to brass nossies mounted under the bumper in front. The water spray the humper in front. The



soline supply meter trucks now being used by the New York Fire Depart-ment. These trucks are of the four-wheel drive type

four 5-gallon cans in the filler box, six 5 gallon safety cans and four 8-gallon oil cans with top stops—ample for the erice they give.
It is intended that the trucks shall

art is intended that the fricks shall carry oil in one of the 300-gailon com-pariments and gasoline in the other two They will be used to distribute fuel and lubricants to the various stations of the Horicants to the various stations of the New York City Fire Department, supply ing the needs for the operation of motor-driven apparatus, and should be of special value in the winter

fortable and roomy as those at hos and complete protection against incle-ment weather are features that will ment westers are teatures that with make it a treat to travel in this latest type of home on wheels. Bodies of striplane pix wood varying in length from 11 feet 8 in hes to 10 feet 5 inches and in heightis from 58 inches (standard) up to 76 inches with standard width of five feet are available. Two to four pas-sengers can comfortably travel in the smaller and medium sizes and two to

semiller and medium sizes and con-six in the larger vehicles, "But how do we eat?" someone may impatiently ask at this point Resilly, it's a simple matter. To the right in the rear is a kitchen cubinet, on top of this is a three-impressive Other cabinets. is a three-burner stove. Other cabinets in such a way that there is no rattle "Where do we sleep?" is naturally the next question for the travier to ask It's an easy job to arrange sleeping quarters. First the sents, which are collapsible are put out of the way. Then the bed at the left side with full size springs is let down and opened up the full width of the car When not in use, this bed with pillows and blankets is projected by a canvas cover. Another bed with full size mattress may be let down at the roor and hold two feet down at the rear and held two feet above the ground by means of chains hooked on to the top of the body. When not in use, this bed is fustened against the rear of the body and is covered by a dust and waterproof canvas.

The bed in the rear is completely covered and curtained by a double tent car-ried on the top of the body, which in the daytime may be used as a protection day (line ina) be used as a protection from the sun when passengers wish to eat outside. Fix this windows are pro-vided in these curtains. When it is desired to eat outside, the cabinet doors which form the table inside can be removed fitted together, and mounted on collapsible legs.

There are boxes for camping tools-all the tools are provided—convenier racks for clothing, a canvas water bottle which keeps the water cool by evapora tion, toilet facilities, electric lights in fact, everything one has in the home. Everything is packed conveniently in small space, and everything one could desire is in its place. In a few minutes, oest can make camp or be on the road to the next stop miles away—wherever and whenever the whims of the party decide The enthusiastic motor traveler, in truth, can go as far as he likes and come back whenever he pleases in this flexible, convenient touring home.



Motor truck touring home in camp for the night and on the road. Note the

New Supply Trucks for New York Fire Department

THREE new combination gasoline and oil supply tank trucks have recently been placed in service by the New York City Fire Department These have fourwheel-drive chassis. They are the type They are the type having traction on all wheels, but steer only with the front wheels, and are the first of their kind to be purchased by the city of New York. These tracks are equipped with 90%-gailen tanks with three compartments of 300 gallons ca-pacity such. In addition, they carry

Motor Touring Home
ALL the thrills and benefits of a long

A automobile trip over mountain road or backwoods trail with the numerous comforts of home and no hotel expense may be provided by the latest motor vehicle, the motor-truck touring home. Where or how long, it matters not, for with the touring home distance and time and inconvenience are eliminated. The touring home! What is it? It is the practical and efficient development of the dreams and ideas of thousands of

In its design, the dominant idea has been to make it available to the average automobile tourist, in other words, to bring it down to what the engineers call a quantity-output basis in its manufacture. Beat ingranity has been exercised in making the equipment complete in its home appointments withcomplete in its nome appointments witn-out being top heavy or cumbersome. Speed and flexibility of operation, more-over, are assured by the fact that the touring home is mounted on an International meed charges.

Are the meals going to be properly cooked? How about the beds? What about rainy weather? These are quesabout rainy weather? Amore are questions that will at once occur to every practical-minded automobile tourist in contemplating the use of this equipment, but he needn't worsy if he is going to hit the trail, this year, the "touring but he frail, this yeer, the "touring bome" way Every facility for properly coaked meals, real bads, just as com-

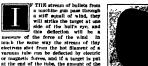


The Cathode-Ray Oscillograph

Measuring Electric or Magnetic Forces by Their Effect Upon a Stream of Electrons

By J. B Johnson

Of the Bell System Research Laboratories, Western Electric Co.



it produces.

This in brief is the fundamental principle of the cathode-ray oscillograph, invested about 25 years ago by Braun, and known by his

vented about 27 years ago by Iraun, and Inown by the name. In Branan's thus the electrons were started by a light voltage between the metal terminals which were swelled limit by the light starter, which was then exwere through the hote in the plate in a contract ward, through the hote in the plate in a content with substances which glowed when struck by the electrons, so that a spot of light industed the end of the stream If an electric voltage was applied between the plates, the attention of the stream of the plates, the attention which the stream will be defected toward the

positive plate, and the spot would move across the screen

The Braun tube had two limitations the air left in it was gradually used up and had to be renewed, and the voltage required was from 10,000 to 10,000 volts direct curvent. This was not only expensive and hard to hundle, but danger ons to the operator. Hence the Braun tube never was used as much as its other good points deserved.

with the deviver way was opened to get the devived stream of electrons more usuals shore devivens are given off a heated filament at moderate voltages in the dewards, F is the filament heated by a sk volt bettery Another butters was usually of small dis vells like the familiar radio "1" butteries, provides 90 volts between the filament and the other electrons of the deviver the filament and the other electrons the deviver was the deviver the filament and the white place through the little hool in the

Iron.

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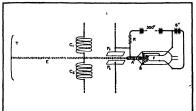
and the other plate is econocied to the delectroid a find so to a terminal outside the tab. Thus a wilnage can be put account from plate Px and the stream of meantive electrons will be drawn toward whichever plate is positive. The movement of the stream at the plates, and so of the wilnage and plate to the movement of the stream of the stream of the wilnage applied to them. Since the stream of electrons has practically no weight, a channel in the applied wilnage is reclaimed channel in the applied wilnage is reclaimed between the stream of electrons has practically no weight, as the stream of the wilnage in the stream of the wilnage in the stream of the wilnage in the stream of the wilnage up to a million cycles per second or the wilnage up to a million cycles per second or

When the thing to be measured in a current rather than a voltage, two small coils of a few turns of wire are placed on opposite sides of the tube. The magnetic effect of the current will deflect the stream in a direction parallel to the plane of the



Over-all view of the tube used in the cathode-ray oscillograph

cults, and the luminous spot will move just as before. In the development of this device one ultimative sourceme in a way which gives an interesting illustrative of the state of the state



The electrical principles involved; for references, see the fourth paragraph of the text

stream aprend out so that if will not give a sharp spot on the target. The remedy was developed by our eadineers, who during their experiments made up a tube containing a small amount of gas. Now every gas is made up to the stream of the stream with electric tit, and surrounded with a number of negatively charped electrons led to the electric stream. The tree electrons shoot down the tube at a velocity of about 500 miles per second, and when one of them



The cathede-ray socillograph set up in the laboratory, ready for use

hits one of these molecules, the force of the collision motors off one or more electrons from the molecule. Formerly the positive charge of the nucleau was neutralised by its ring of negative electrons, but when some of the electrons are knocked off, the nucleus, now positive, begins to attract the free negative electrons. Since compared to the flying electrons, they are simply buffeld around by the latter, and they stay for a time in the line of the electron stream where they were formed. Thus there is along the whole length of the stream a line of positive nuclei which

electron stream where they were formed,

she was the size of the stream a line of positive nuclei which
the stream a line of positive nuclei which
the stream a line of positive nuclei which
the stream that the size of the repulsion between
electrons which tempts them to sureed out Further,
the disologed electrons also that off in all directions
soon fill the space outside the stream with negative
two in their own path, they describe and under them

charges, when represent the control of the tuner times of this tube oscillograph comes from the fact that the stream of electrons forms a nearly weightless pointer whose movement will accurately follow the changing conditions in the circuit to which

anging conditions in the circuit to which the concentral fluoriety to be shile to the concentral fluoriety to be shile to the concentral fluoriety of the ship to the ship to the ship to the ship to draw the beam back and of the sput during consecutive swings will not overlap. Up to a few hundred cycles per second this can be done by waving as but mangaret back and forth near the tube Since the electron stream is really the Since the electron stream is really an ungaretic fled but il the a wire carrying a current of the ship to t

In most cases, however, what is wanted is the variation of a high-frequency current not with time, but as some otherquantity is varied. For instance in radiotelephony it is often desired to know the variation of the radio-frequency modulated current with the volce-frequency input to the modulating tube. This relation is of utmost importance as it indicates whether the outgoing waves will set up an undi-

torted copy of the original spects when her practic the receiving rations. In this case the circuit are so exactly on the receiving rations. In this case the circuit are not called to the received for the recei

The chief value of the cathods-ray oscillograph is quick gig quick an electric circuit. Thus it can be one are the control of the control of

and for demonstrations before classes to about 20 persons, this device shows what is happening with a clearness that is most convincing.

The Most Famous Taxi in the World.

World

"TAXICAB 2692 G- will never wear out
how suffer a collides, for it has been
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Marin" and has been placed in a position
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in formation, at the great pure-we agrade.

Recently Patented Inventions

Brief Descriptions of Newly Invented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Chemical Processes
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is first brought to a temperature of 120 dedecreased to the second of the contine which the control of the color
of the when the correctly heart is added in
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METHIOD AND APPARATUS FOR

them out of the ground, the device having from the well. The device includes dilarious for the wists the control of the visit of grove Centigrade to 120 degrees Centigrade, and the second of the wists the control of the wists the wists of the wists the wists of the wists the control of the wists the wists of the wists of the wists the wists of the wists the wists of the wists of the wists the wists of the wis

cink means for effecting the boility oscillar-leads is provided with means for editoriants; purchase so the water forward of the lab tion of the fame whole branching the size convent and as one rable by the operator of the ma-produced by the fan is continuously diffused over a constantity changing area.

GRASS-DIGGING IMPLEMENT — W - (a) PRESENT — W - (b) Play. of Water and Supply, Rosellar

constantly changing area.

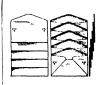
| Constantly changing area. | China. |













Construction Day by Day

growth of demand for telephone ser-vice that the Bell System savests throughout the country an average of three-quarters of a million dollars every working day for new telephone

New acrial lines are always under construction or extension, new sub-ways are being dug and cables laid, larger building accommodations are under way, more switchboards are in process of building or installation, and added facilities of every description being mustered into service to care for the half milhon or more new subscribers linked to the System

This nation-wide construction, this large expenditure of funds, could not be carried out efficiently or eco-nomically by unrelated, independent telephone organizations acting with-out co-operation in different sections

of the country Neither could it be carried out efficiently or economically by any one organization dictating from one place the activities of all. In the Bell System all the associated in the Bell System all the associated companies share common manufac-turing and purchasing facilities which save millions of dollars annually. They share scientific discoveries and saventions, engineering achievements, and operating benefits which save further millions. But the management of service in each given terri-tory is in the hands of the company which serves that territory and which knows its needs and conditions.

By thus combining the advantage of union and co-operation with the advantages of local initiative and responsibility, the Bell System has provided the nation with the only type of organization which could spend with efficiency and economy, the millions of dollars being invested in telephone service.



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Electrical Notes

Summaries and Excerpts from Current Periodicals

at a mile a minor.

The Electric Steam Generalizer is a promer product of the General Electric Steam as the second product of the General Electric Steam as he will believe and electric chamber above. Water is fed into the bet well and by the passage of current through the water. The purpose is to furnish steam for best-dependent of the product of the product steam of the product steam and the product leading is not economical, such as over weekends and during the spelte good versa.

William spelte could versa.

nomical, such as over when the pring cool waves.

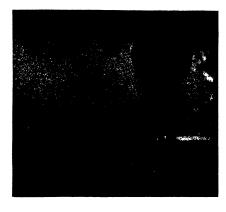
Bare Aleminum Conductors. — While aluminum has been employed for some time back in high voltage transmission line work,

and a such all for heavy current bus back in high voltage transmission line work, its use as a material for beary current bus bars or for other bars station conductors is still to be established. Record experiences in England common to the state that for each copper with a considerable away. In said-tion, the weight to be supported by the in-sulators would be halved by such a substitu-tion, and other advantages are gained in the matter of more ready installation and better

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The New Tusks Popular No. 225

Regenerative Receiving Licensed under Arm Patent No 1,113,149

Special circular 20-A sent on request

Like a good old reliable friend

Y perfect faith that it is always ready to be called upon. There is no fussing or coaxing-no apologies for its shortcomings. Year after year you can count upon this rehability of performance. New models will come, as in pianos and fine motor cars. But few will discard the old and buy the new for the sake of minor refinements. The Tuska set represents the highest point in radio development to-day; you can buy it for the future with confidence.

The Tuska is the ideal set for busy people who want the thrills of radio without the tinkering. It is simple to operate. You turn two dials, listen, and select the exact program you want from the dozens which fill the air. Nothing is forced upon you by the near-by dealer who can show you the Tuska.

OU turn to your Tuska radio set with limitations of your set—every broadcasting perfect faith that it is always ready to station within hundreds of miles is within the call of your Tuska. A letter from Prince Albert, Saskatchewan, Canada, says, "We have tuned in clearly over 100 stations and most of them are more than 1000 miles away"

Tuska sets are built under the personal direction of C. D. Tuska, a nationally known radio pioneer and builder of fine apparatus. For a dozen years Mr. Tuska has been keenly critical of all radio parts and sets bearing his name As a result, the Tuska seal is recognized as a guarantee of the most thorough New England craftsmanship-and there is no better.

We will gladly send you the name of a

THE C. D. TUSKA CO., Hartford, Conn.

First to hear across the sea

A Tusin Receiving Set was the first to receive foreign amateur trans-Atlantic code



During 12 years that Tuska Radio Apparatus has been in use, we have accumulated records of long distance radio reception that have









Transplanting Osborn, Ohio

When the rains descend and the floods come, Osborn, Ohio, won't even get her feet wet, thanks to the giant strength of Yellow Strand Wire Rope and a few husky tractors.

Government dams, built to prevent floods at Dayton, would cause Osborn to be submerged eighteen feet during high water Hence the migration of over a thousand people with their 400 buildings to higher ground a mile and a half distant. It's a row-par task

Wherever big jobe are under way, there you will usually find Yellow Strand Wire Rope, selected because of its dependable strength and long life

The manufacturers of Yellow Strand also make all standard grades of wire rope, for all purposes, each unsurpassed in its class BRODERICK & BASCOM ROPE CO., ST. LOUIS America: New Yorkhad South Featuring St. Louis and South

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Let ROOT COUNTERS solve your counting problems. Any kind-send them in.

Have you our Text Book on Counting?



Miscellaneous Notes

Odd and Interesting Items from All Sorts of Sources

to the blind.

European Daylight Muddle.—Tourista are going to be bedevilled all summer with the vagarie of European time. Summer-time began in England on April 22, in Belgium on April 21, Holland, Germany and Grind on April 22, in Belgium on April 21, Holland, Germany and capture in the Particle of the Company of Company of Company of Standard.

armor has encosmbilly withshood products fairly mar for tool day?

Tarning Out Letter Boxes In Navail Compression of the Compre

Sailing Balla by Phana.—Listening by worting the materials in the mold, which long distance interphone from Roston to the world have necessitated reporting the settings of sweep biles at Trye, N. Y., senterprocess, and the second of the sec

000 horse for hold of these years.

Regenerated Beverague.—The country is being stooded with direction would in the most should be sufficiently supported by the support of the support of

citative in many centres of India, where it is cut that risks, because it is a cut that risks, bruckless and other whapes.

Armsor for Pelica.—The war resulted in an evention to the narrow of in-indiance and in the result of the narrow of in-indiance and in the result of the result in the result in the result of the result in the result of the result in the result of the result in the result

The Earning Power of Better Lighting



The merchant knows it, the tenant knows it. They have seen the results in increased sales and increased efficiency.

But many readers of Scientific American who erect and lease office buildings and stores may not have realized that better lighting results in more profitable use of floor space, better tenants, larger rentals and fewer vacancies.

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A giant worker-excavating over three hundred thousand cubic feet a day! In three days, six hours and thirty-six minutes, it could handle material equal in cubic contents to the Washington Monument.

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GENERAL ELECTRIC





For Rapid Action

This valve is one of multiple advantages-ope wide with a pull of the lever, stays open automati-cally, closes by a slight pull of the lever It is fitted with a Jenkins renewable disc; and another point of unusual merit is the absence of water hammer on closing. oly adapted to an intermittent operations flow of water or steam is required

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Science Notes

A Digest of Everything of General Interest Appearing in Current Literature

Saving Our National Parks.—The American Association for the Advancement of Science west on record at the recept meeting as urging the complete asforgarding in perpetuity of all national parks in the United States and Canada against every economic or commercial use of whatever kind.

Interference with Paris Observatory.—
The famous Observatory at Paris may have to be moved outside the city limits on at count of the tremore due to the subway. The Academy of Sciences are attempting to find a remody and if they are unaccessful the Observatory will probably have to more.

Rettlemnke to Be Gassed in U, S. Aray Expariment.—Mustard gas, phospone and chiucine, desdy accompanisons of wax, will be turned upon large does of rettlemakes in the vicinity of 88s Marcox, Tor. The experiment is to be made by special order of the oklet of medical warfare, Washington, D O.

remainder the control of the control

(Continued from page 184)

(Cheatheast from year 14))

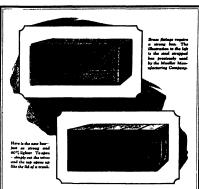
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"A Small Private Laboratory" | best when the other ear was its worst, and vice varies.

Hearing Without the Ears

Harding Without the Earn
At the time the Choosi's end is nations
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necessary for the recording of sound impresshous by the human brain. One of the
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should be conder to speak into a miserphose treasmitter You sit down in a chief,
and an instrument comprising a standard
coming out of the ser can, is applied to varicus bones at the base of pour skell No
sounds are heard from the instrument, yet
the proper bones, the sounds are distinctly
approximate—we won't say heard, but they
are nevertheam dearly made out. This
year nevertheam the service of the proper
approximation.



Saving 60% in box weight without sacrificing strength

The H. Mueller Manufacturing Company for years used excellent wooden boxes, strong, well-made, steel bandedbut expensive and heavy

After General Box Engineers had analyzed their shipping requirements the Pioneer Wirebound Box, weighing but 40% as much as the old box, was recommended, tested out and adopted.

The carrying strength of the Pioneer and the old box were equal-and both were protected against theft. The actual savings were

(1) Lower cost per box; (2) Lower transportation charges; (3) Lower assembling cost, (4) Lower packing and closing costs.

In addition, the H Mueller Manufacturing Company provided their customers with a container that could be opened in a few seconds without damaging the box and could be unpacked quickly and re-used

In this instance the total savings made possible by this . new container were very much worthwhile. It is a fair example of what might be done for you

Our box engineers will be glad to study your requirements and offer suggestions. If you cannot use Pionee Boxes or Crates they may be able to help you with other ideas. We make all kinds of wooden shipping containers.

Through our sixteen factories we can give you close at hand service A bulletin on boxing and crating - "General Box Service"-will be sent free upon your request

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Botanical Notes

Dates from Asiatic Turinary. Turkey supplies most of the dates into the United States. In 1921 ports of dates amounted to 4 pounds, of which 28,000,000 pour from Turkey in Asia and more than pounds from Paleatine and Syria.

journels from Pelastine and Syria.

Orderstoped 169 proportions of the peasur and 115 of the sweet potitot, has make potast and 115 of the sweet potitot, has make potast and chimberry mad from the delinherry table products. It is also delinherry table products. It is also devised a dressite and the same of the sweet potitot, and the same of the same of



A 21/2 Mile Cut Through Brass with ONE Saw Blade

and the blade is still running

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Starting a Company? Stem of Stem and Intelligence of the Stem of Stem and Stem of Stem of



"A Small Private Laboratory"

"A Small Private Laboratory"
(Consisted from page 501)
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And Ahost the Man Behind the Idea It would not be right to close this secount of Elevenau Laboratories without a little sketch of Colonel George Fabyan, although we were told that the Laboratories were the thing to describe and that he was not to be mentioned Brill, the Riverbank idea is the Colonel personified, and we must therefore sketch a word picture of this remarkable

we were beld that the Lakovateries were the thing to describe and that he was not to be the the total and that he was not to be the the total and the total



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\$50-\$500 WHEE, Free mamples Cold Letters for store windows. Besity applied. I though offer to spread applied. Letter Co., 440 Morth Clark Str., Obsessor.





Sprayed Rubber

(Coninced pres page 185)

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This Heater Also Ventilates

Here is a real operating econony—the Skinner Bros. (Baetz, Patent) Heater is also a ventilator It actually keeps every part of your building at a comfortable working temperature and at the same time can be used to supply pure fresh air in any quantity desired.

This heater is the pioneer of its type. Its construction is unique—there are no cumbersome outside ducts or pipes used to distribute warmed air. The cost of these fittings is saved—the space they occupy can be used to better advantage.

The heater is very economical—it needs to be operated only a few hours morning and afternoon even during coldest weather. Satisfaction guaranteed.

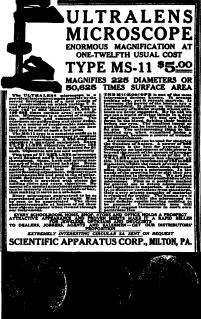
Read Over These Names of Users

Among the many users of Skinner Bros. (Baetz Patent) heaters are: Ford Motor Co., Detroit Filtration Plant, Lakehurst Naval Hangar, General Motors Co, Federal Foundry, American Stove Co, Maxwell Motors Corp., St. Louis Independent Packing Co., United Paperboard Co., and many others.

GET CATALOG RA

SKINNER BROS. MANUFACTURING CO., INC. Main Office and Pactory: 1474 South Vapdeventer Avenus St. Louis, Mo., Bestern Office and Pactory: 140 Bayers; Elizabeth, N J an Linis Mar. Baths, 500 Horpes May. Cheep, 1700 Feebra May. Chrosinet, 613 House Industrial, 1400 Enther; St. Wash, D. C. 714 Brens May. Fish, Pa., 1711 Suppose PRINCIPAL STREET

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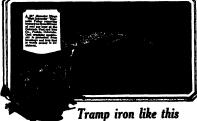
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it is high time the schools that produce such people were looked into and shaken

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Radio Notes

A Review and Commentary on the Progress in This Branch of Rapid Communication

The Breadcast Central Station has pow locations versions—the amplifier Than the City for several months, and has been functioning very well haded, especially in the property of the control of the station in the heart and the location of that station in the heart and the location of that station in the heart and the location of that station in the heart and the location of that station in the heart and the location of the station of the s

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Every Radio Fan Should Have This Book

cal diagram.

Tou may dip into it at random, or hunt up special information you want, or reach type of receiving and sending hook-ups are explained, proposed insur-



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Psychic Adventures at Home (Continued from page 184)

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GIMBEL BROTHERS MILWAUKEE

Gimbel Brothers purchased almost \$2,900,000 retail worth of Radio Sets from the Radio Corporation of America WESTINGHOUSE R.C. SETS Westinghouse R C Set Pair 2,000 Ohm Phones

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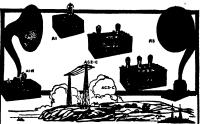


tion (with KELformers) results duction with tion and maxi-Kellogg transsigned to over-of existing types the very best of

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Radio Takes Another Step Forward

THE new Magnavox models (rapidly being distributed to the trade) extend and supplement the already famous Magnavox line, which now includes a Magnavox for every receiving set.

A brief summary of Magnavox products is given below:

Magnasox Reproducers R-2 with 18-inch curvex horn. \$60.00 R-3 with 14-inch curvex horn. 35.00 M1 with 14-inch curvex horn; requires no battery for the field. . . . 35.00 Magnavox Combination Sets

A1-R consisting of Reprodu-cer R3 and 1 stage of am-plification. \$59.00

pilication. 489.00
Al-R consisting of Reproductor R1 and 2 stages of am pilication. 585.00
THE MACONAPONE COMPANY
Al-M same as A1 R but with Reproducer M1 . 59.00
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A2-M same as A2-R but with Reproducer M1 85-00 Magnavox Power Amplifiers

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What Is It Worth To You TO KNOW?

Many times a day you face situ-ations that compél you to draw upon your reserve of knowledge It may be in the office or among business associates, it may be at the club or in a social gathering. It may be in any of the activities that make up every-day life What is it worth to you in influence and leadership, in dollars and cents, to meet these demands without hesitation? What is it worth to you to be the man who knows and win the admiration of your friends, the respect and confidence of your associates? Your success and satisfaction in life rest so largely upon your reserve of knowledge that you must, in your own interests, have readily available such an infallible source of knowledge as THE

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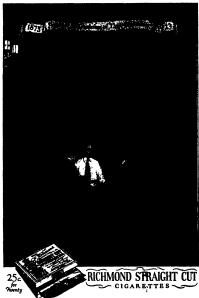
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(Continued from page 178)
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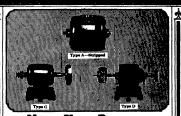


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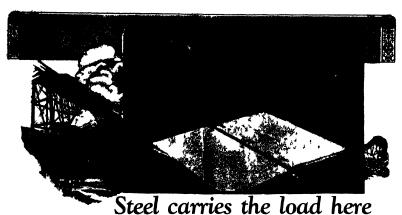
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and consequent freedom from vibration and sticking and binding, Skayef self align ing ball bearing have made possible ma-chines of this type, used for balancing ma-chine elements up to 150,000 lbs in weight

The use of ball bearings for the delicate dynamic balancing of heavy rotating parts is indicative of the freedom from wear and vibration that accompanies their use on the common machines of industry, transportation and selence where they also effect substantial power savings

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Money is only the symbol— Time is the universal medium of value.

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drift-wait-wish-watchhope—and your future is beset with chance and question.

Invest your Time-workprepare—constantly increase your ability to render Intelligent Service—and your Future becomes as certain as human destiny can be.

Hesitation—procrastination
—inaction—the thought without the deed-are the universal enemies of mankind.

But they have yet to conquer any man who really fights.

Interesting Facts About LaSalle

LaSalla Fetronio. University was founded in 1908. Its first course was in founded in 1908. Its first course was in Law, and the method it employed was so different intent the old-dimensor respondence with the contract of the second of the s

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—yet all had the same good opportunity!

If someone should tell you that five years from now you would be sunning yourself on a park bork—not of work, out of lock, and a probably tell him in no uncertain terms that he was a lar.

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may show half SOUTECTED their follow
a pockal ability to do some appoals thing—were a
best to hold their own against depression.
During this period: feet men who have
supported by the second their conspecial work does not always equal apply!
Bet—make no missibe—their lot works.

WORK.

WORK.
And in countiese instances it was the
LASALLE-TRAINED MAN who was retained when others were let go—and in
counties instances be won promotion.
There comes to mind, for example, the
experience of Sidney Linchtenstein, of Philadelphia, who in August, 1920—just as the

Secure In Their Jobs

O per cent." J GLERN HOREM, userque What Will YOU Write Home to the Folks? What does the future hold, for YOU? M. Will you write hack home. "I was head a "yell with the action of the future of the f

With the Editors

ONE of the things which we have learned to look for in Monday morning's news short in the catalog of the motor fathilities of the west-end. And the motor fathilities of the west-end. And the read over this long red.; is that in napority of the wracks were caused by bad driving or bad equipment. Sometimes the wickins be the same of the west-end with the same than t an "act of God" in the sense that it was not to be anticipated and avoided, is rare.

THE percentage of car-owners who are criminally reckless in their driving or A criminally receives in their civing or in their care of a car is no larger than it has always been—we suspect that it is even iess. But in aggregate numbers, the spread of the antomobile causes this class to be ever increasing—faster than they still themselves off, unfortunately, and as kill themselves out, unfortunately, and as the congestion of our roads grows ever greater, the probability is constantly larger that a car which gets away from its driver will find another fellow to smash up.

THE condition must be faced, and the remedy sought. Traditionally, the American is proue to adjust his troubles by passing a fock of new laws, so it is not to be anticipated that we shall come to be anticipated that we shall couse intrough the pussant crisis without the usual fixed of suggested new legislationsome of it duthese well considered, but most of it, half-baked or even rawer than that But whether the cure lies in new enactments, in different administration of those we have, or in some other direction quite unconnected with the law, it must be found.

A 8 our own contribution to the discus-are going to seek out the opinions of a quantity of people who are in positions where they must necessarily have formed opinions. We shall draw upon all avail-able sources for viewpoints and for facts. The result will be presented on these pages. Whether it will take the form of pages. Whether it will take the form of interviews, of carifibited articles, or of editorial compilations of numerous opin to an open given and the compilation of numerous opin to a compilation of numerous opin out "questionnaires" on similarly timely topics before, and perhaps we shall do so again. In any event, however we handle it, this contribution to the clarification of the automobile problem will be one of the features of our coming issues.

volume was printed with a desen blunders of composition — which were promptly called to the editor's attention by readers.

THE sense reader on always be de-putied upon for this. Some of them are seresaits, some contemptous, some in search of a job, some abselve—and some, of courts, anisanted entirely by the sincere desire to be of help. Publisher and author and editor are always sind to have the typographical error brought to their attan-

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The state of the s

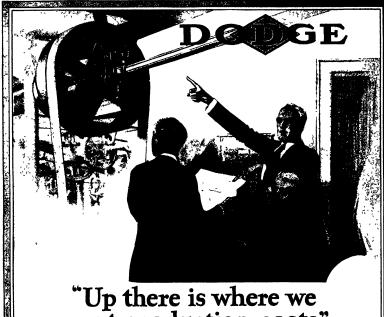
tion. They would be better pleased if the average reader were sufficiently aware of the nature of the case to realize that a small residuum of such error is unavoid able, but that is probably too much to ask

IN our own case, the ordinary hazards of human fallibility are further com-plicated. The final reading given our articles in this office is ordinarily by the member of the staff who actually wrote or edited the thing in the first place Under these conditions, it is even onsier than usual to slip part a wrong letter or a wrong word. One knows what one wrote, a wrong word. One knows what one wrote, and in spite of everything ones spe will be guided by this knowledge and read the lext as it ought to be rather than as it is. Thus it is that we make Professor Russell site the Marcher defection of light as 175 inches and 175 minutes, in the same art it is, in the same and 175 minutes, in the same art of the contract of the

Title psychic investigation goes on apace, and will have its due share of our space for many months to come After a bull following the unfavorable sittings of May, we have on our hands several further mediums, with whom sittings ap-parently will be hald in time for publica-tion of the results in one of the two retion of the results in one of the two re-maining beauts of the year. In the mean time, Mr Bird's book is now passing through the press, and there will shortly be available this much more complete, the available this much more complete. The beautiful press of the pressure of the horter of this informal eye freeze than there the beginning of this Purepean trip. His address band of this Purepean trip. From the beginning of his Furopean trip this volume had been in mind and he accordingly sent home, for abstraction for the paper and filing against his return, the most detailed accounts of all his sit tings. Though his articles in the Sursa tings. Though his articles in the Scientific American have been most interesting it is quite obvious that he could not there give all details. On the two Sloan senaces, for instance described in some 4000 words in our May issue he had writ ten over 12000. Those who feel that they are interested in the subject need not therefore refrain from reading Mr Birds book through fear that it will too largely duplicate what they have already read in month to-month installments.

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A MONG oils r interesting subjects sched used for early treatment is the way the water department of a big city wages constant warfars against the billions of billions of microscopic foes in the precious fluid the development of high explosives therefore have to be thawed out, with the is ril that accompanies this operation, the use of compressed air in midget wind funnels to get practically all the results that could be attained with a glant tunnel, a remarkable new speed-changing gear that works through an oil pump, without any meshing wheels the scientific study rant has reen made by the recerning Government of the part that distribution costs play in our economic system as contrasted with actual costs of production Mr Kiemin's admirable resume of aviation Kleuta's admirable resumé of avintion progress will be continued, the second in-stullment having to do mainly with gilders and the correlated low power planes. A resursable salvage understaking upon an English esthedral which was crumbling with age will be described, and it will be told how hypodermic injections of concrete the old will be a second to the concrete the contraction. in the old walls saved the structure. And so on-only there isn't any more space to



"Up there is where we cut production costs"

SUSPENDED from the ceiling in your factory may be a thief that is responsible in part for the red ink figures on your monthly balance

Look up and see for yourself what kind of material has been put into your road-bed-ofpower That road-bed has a tremendous bearing on power costs.

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VERYTHING FOR MECHANICAL THE

SEVENTY-NINTH YEAR

THE MONTHLY JOURNAL OF PRACTICAL INFORMATION

NEW YORK, OCTOBER, 1923



congested cities. The suggestion is made with particular reference to New York, but is of universal applicability One way in which traffic could be made to flow smoothly through

WY YORK CITY is laid out a Sunkern Boulevard for Automobiles of Park Avenue at the Grand Central and though the city has splited out in all and though the city has splited out in all and though the city has splited out in all and though the city has splited out in all and though the city has splited out in all and though the city has splited out in all and though the city has splited out in all and though the city has splited out in all and though the city has splited out in all and though the city has splited out in all and though the city has splited out in all and the competition of the city has splited out in all and the city has splited out in all and the city has splited out in a competition of a discovery of the competition of the compet

Protecting Our Great Banks

Armor of Concrete and Steel that Aims to Foil the Scientific Cracksman

By Edward H. Smith



A memorable Monday morning in 1878— October 28, to be precise—the cashler of the old Manhattan Savings Institution turned his key in the lock of the street door, walked nonchalantis into the bank

stranger things in the face of miracles, and one had been wrought here The door of the great from vanit gamed The state of

wrought here. The door of open torn and twisted on its hinges, as though a Titan had wronched it with the weight of mountains and the power of tides. On the floor was a litter of papers, a ccount books, coins, pieces of shattered iron and ends of broken tools From the interior of the huge metal box long considered beyond the strength and ingenuity of men, was missing a total of \$2,747,700 in cash and lands. The greatest bank robbery in our history had been committed between Saturday night and that

The cushler revived, summoned the other officers in haste, closed the doors and put up a sign relating that the bank had been forced to suspend because of robbery Policemen came in droves, crowds gathered and tried to storm the en the news spread through the city and across

the country runs on other banks began and were checked with difficulty. The corner of Broadway and Blocker Street, where the bank stood, was obstructed for many days with crowds of curious people who had come to see where this astounding thing had taken place. The doings of a small gang of crackmen be-

place. The deligs of a small gang of crackemen be-came a piece of history. To this burglary just forts five years ago, is to be traced the beginning of modern developments in the protection of our great banks against criminal attack, concerning it

A gang of notorious professional bank burglars, bended by the famous Jimmie Houe, had laid plans for the attack on the Manhattan Savings Institution and consumed all of three years in working out their scheme They had eventually corrupted one Michael Shevelin, the bank watchman, gained entrance to the place with his bank watchman, gained entrance to the place with his collusion and worked on the vault door with wedges, powerful jackscrews and explosives, through the nights of Saturday and Sunday, finally reaching the bonds and cash at about 3 30 octos on Monday morning. Their loot consisted of \$2,500 700 in registered bands. \$73,000 in coupon bonds and a fortune in cash. To save the bank from disaster and foll the robbers, the Congress and from obsister and for the robotes, the suggessor and the State Legislature passed acts cancelling the stolen registered bonds and causing fresh securities to be en-graved and issued in thoir stead. To such lengths the nation had to go to protect its finances against a few

It must not be assumed that such a burgiarious raid as that on the Manhattan Savings Institution had hap-pened without precedent or that the banks had not done lary of large banks was an old story in 1878, and gre lary of large banks was an old story in 1878, and great quantilies of luvative energy and of bank insney had then already been expended in the queet of some method of vault centration that could be relied upon it is interesting to note some of the ideas them applied. The vault of the old Autienan Park Bank, when it was finally dismutted some years ago, to make room for a modern substitute, was though to have been built

what mainly tous materials are years also, to make room for a modern substitution, was found to have been built of solid slabe of granific, closely fitted together. The ediges of each ands slab had been incised with a series of hemispherical depressions, which fitted precisely to similar secoplage from the adjoining granie blocks, thur forming globular holes, five or six inches in discovered the state of the short of

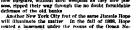
placed, so that if a burgiar tried to enter the vault by digzing at the joints of the stanes, he would en-counter the loose cust from balls. Another vault, of a slightly later period, had been

formed, indde a construction of solid masonry, of two plates of cust true, each about one and one-half inches The inner face of each of these plates had similarly been cut with innumerable hemispherical depressions which fitted

against other such cuttings in the opposing plate. Into the spherical holes thus formed had been placed large numbers of chilled cost iron balls, like large ball bearings. The notion was that these loose balls would deflect the drill of make his way into the vault It must be remem-bered that nitro-glycerine that the burgler had to that the burgiar had to drill holes to get at the tumblers of the locks or to blow in the gunpowder which was then his only

rplosive agent

But all such precautions
ere not of much avail, for were not of much avail, for the reason that the better bank burglars of the day understood how to attack the strongest vault doors then in existence Invention had provided nothing better than heavy, close-fitting doors of cast iron, chilled and later case hardened, but iron doors, after all shall have a word to any about the evolution of the vault door. For the present it is enough to observe how burglars, without such weapons as they now pos-



rented a basement under it itomal flank at the corner of Fulton and Greenwich Streets and opened a car-pet business. In front was his show room, in the rear-his work room. To divide these and keep customers and pussers by from intrud-ing on his privacy, he had a pustifier oversted divid. n partition erected, divid-ing the two parts of his establishment In reality put in place to mask his put in place to mask his operations against the bank, whose vault be had carefully studied.

Huge rectangular plug door closed, showing the

curefully studied.
On the night of June 27, 1860, nine years before his greater feat at the Man hattan bank, Hope and several assistants, including the famous old robbers Ned Lyons, Mark Shinburn of George Blies, reached and George bines, rescned the bunking rooms by means of a hole they had been alowly cutting through the ceiling of their carpet store and the foror of the bank. They went to work with wedges. First a fine meaning with the store of the store of the store of the meaning was the store of the s

wedge, no thicker than the blade of a knife, was ham-mered into the crack of the door near the lock. A mered into the crack of the door near the lock. A slightly thicker wedge was next pounded into place with sledges, and then a still heavier tool took its place. Gradually the burglars worked their way up to wedges two or more inches thick at the bess. These were forced home with big Jecksrews, which got their pur-fered home with big Jecksrews, which got their purchase from beavy lives hands or cables which has been proseed around for waith or secured to its back by beavy hooks. Gradually the jacks were turned until the their wedges forced their way in and price the door from its iron jain. The holts were now forced back and the iron jain. The holts were now forced back and the them and on the lines irre door. "The robbery located \$1,000,000, or which, fortunately, the larger part was in non-negotiable honds.

the most on the laner front door. This robbery totaled to the most consequence of this mode of attack, the control and the most consequence of this mode of attack, the control and door came to the matter of chair on care with the wall builder. The first heavy doors has a consequence of the most first first heavy doors has seen that the same that the limits face of the door being narrower that would close more lightly, came the breviled or sloping edge, the limits face of the door being arrower that would close more lightly, came the breviled or sloping edge, the limits of the same that the same th

The construction of such doors is one of the marvels of modern vault engineering. Entirely ande from its complicated multiple time-locks, its numerous powerful holts, its intricate inner locking devices and its other inical intricacies, such a door is a first-class piece

a door is a first-class piece of reaglacering. It seems to the eye to be a solid piece, yet if consists of many layers, it is a composite in more than cone eases. The layers, to mention only some of them, are ordinary strain restating steel, refarered concrete, used against fire, hear resisting metal, to delay burgiare operating with the cutter-burner torch, tool resisting burner torch, tool resisting metals; at least one and often two layers containing the wires and folk of elec-tric burgiar alarm systems.



A 30-inch thick block of steekrete (concrete and steel) after a laboratory attack lasting only a few minutes, made with modern tools

and to Off.

Both transactions doors with the control of the contr

They must be designed to foil any possible or conceivable method of assenti. In addition, they must be constructed to resist five and the tremendous heat filely to be developed when a great building comes into constiguration. In constiteration of this risk, the roofs or ingration at the first of today must be even stronger than the floor, sides and front or door, for the roof must be additionally reinforced against the impact of falling bodies from above, in case of the collapse of a building through fire or earthquake

What kind of engineering is required for the achie What kind of engineering is required for the achievement of such projections airmatist may be prossed when must of such projections are provided in the project of the such as about 90 tons and each of the three rooms has a second or emergency door, used for ventilation during business hours. The weight of each main door with its vesti-bules is in excess of 300 tons and the materials comm are those strendy listed, tool resisting poung inem are those aready insed, tool resulting motals, site, avelyiese forch resisting metals, rein forced concrete, cables, shurn wires and the like. The vault downs of this bank are not of the plug type an other and unique design having been employed to suit the needs of the building in which the vanits were

In describing the structure of the walls, floor and is of our great vaults, it is to be remembere

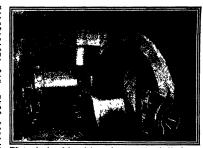
roofs of our great vaults, if is to be remembered that no standard has yet been arrived at, that a number of engineers entertain conflicting ideas about certain details of construction and that ward. Again, the whole difficulty in arrive ward. Again, the whole difficulty in arrive many that the standard of the contraction of the contract of the con small banks, I accentuated the fact that a race, like that between the gun maker and the builder of battleship armor, is in progress and has been for at least two generations. The same thing is true of the great bank vault. There has not been the great bank vault. There has not been a successful burgiary countitied upon the vault of any great metropolitan bank in this country since 1878. Nevertheless, industry and the arts have gone shead and perfected a number of tools which might at any time be employed by burgiars of sufficient skill and daring to seize the opportunity. To this class belong the election of the section of the service and the secret and resument of their portunity To this class belong the electrie arc, the electric and meanuate chiest,
the electric drill and the oxy-acetylene
torch in its latest development.
This last named tool is of especial partl and interest

I have previously written of its effectiveness against the safes and vaults employed in rural or suburban banks and the defeats met by manufacturers of strong

oxes for this clientele. now appears that the cutter-burner tool, as it is preferably called by vault engineers, is a decided menace even to the great hanks and their nonder ous equipment, so that much reconstruction and endless exreconstruction and endless ex-periments are in progress. To date nothing has been found that can be called a genuinely effective resistant

The effort to find metals which would foil the wither-ing flame of the torch is not without its note of roman When the oxy-acetylene cut ter-hurner was first employed there was a great samper after heat resisting metals and a number of compositions were produced which with stood the fery tangue of the torch fairly well (I mean to say compositions sufficiently low in cost to be commercially useful) When these discovthe oxy-acetylene cut useful) When these discovuseru) when these discovered eries were made the valid and safe building world breathed easier again, but only for a short space. Then the investors of the torch discovered

more space. Then the inventors of the torch discovered that they could add immensely to the cutting and fusing power of their tool by using the se-called fluxing rod. Their purpose was, of course, to even the first purpose was, of course, to even the first purpose was.



Fifty-ton plug door of the vault in one of our great private banking houses.

The floor is removable. The door is 35 inches thick

that they would foil the burglar or hold him in check for days. Here, again, a considerable blunder was made for, while reinforced concrete does give a maxito the torch it is comparatively

in the face of explosives and the black sower tools which the highest type burglar might command under special cirunistances. All this was brought out by laboratory experiment and especially by a of tests made under the auspices of the Federal government at its artitlers proving grounds two or three years ago All kinds of vault materials and constructions were there placed under every imaginable form of strain and subjected to all manner of attacks. It was hoped to develop a material or method of con-struction that would resist the worst buffetings for several days. I believe I am revealing no secret in saying that nothing of the sort was found and that the maximum period of resistance achieved was

num period of resistance achieved was not more than a few hours. According to Mr. Frederick S. Holmes, the celebrated New York bank engineer, the ideal vault of today is, like the great doors, just described a composite. Its walls, floor and ceiling are constructed mainly of a special type of reinforced conm system crete, but many other materials figure in the structure. In the first place, the concrete is reinforced with such slight materials as

woven cables and lengths of steel rails. Again the con-crete walls are full of anchors facing both outward erete waits are till of anciors racing both outward and inward, so that if burghing should succeed in cut-ting a plug out of one of these thick walls, they would be unable either to push the plug absend of them into the vault or pull it out toward them. They would be forced to break it up into small chunks and thus gradually make an aperture large enough to admit them in addition, the best wall, floor and celling construction of vaults now calls for both linings and interlinings of various metals, very much like those employed in the great doors.

To nake his way through such a lined, interlined, reinforced and unknerd wall of concrete, usually from two to three feet thick, his bursian would need, first of all, to break surely the outer layers of concrete with need interlining, which he would be forced to attack with the torch and vod. This does, he would again face great thicknesses of concrete, filled with reinforce counter a layer of various unterlas which would come more call for the torch. And, last but by no needs more call for the torch. And, last but by no needs of the all the control of th To make his way through such a lined, interlined,

The vault butter, nowever builds independently or the ularm. He builds a wall capable of turning back a burgiar even if the alarm does not function.

All this being understood, it must still be admitted that even vault walls of such menumental strength. and intricate design night be breached in a few hours by burglars having the maximum of technical knowl edge, the fullest equipment of the best tools, the best (Continued on page 283)

the others must be taken into consideration when a vault is When it was first realized what the cutter-burner and rod would do to metals, many yault engineers turned their macks abruptly on everything but reinforced concrete as a



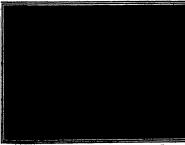
Ready to pour a great vault for a Federal Reserve Bank. Note the reinforce-ment reds for concrete interisced with the cables for burglar slarm system

e of the torch, but what they turned out proved to be a most formidable burgiarious tool

The fluxing rod is a stick of soft steel. When the

flame of the torch is applied to any metal for the pur pose of cutting and inciting, the end of the steel rod is placed at the tip of the finne and against the metal to be cut. The very rapid oxidation of the soft steel rod raises the normal tempera tures produced by the to enormous levels and the addi tional excertating effect of the from oxide enables the operof this device to cut and burn his way with tremendous rapidity through any material or combination of materials now known to practical use The power of this tool and all

put reinforced concrete us a proper material for vaults. Consequently some vaults were built in which this ma-terial alone was relied on, walls of extraordinary thick ness being laid in the hope



ale switchheard in the watch captain's room of the U. S. Treasury at Muston, D. C., which indicates operation of doors, time locks, and so on

Some Curious Comestibles

Amazing Articles of Food that May be Unearthed in Odd Corners of American Cities

By L. Lodian



A grotesque food from the rivers of Manchuris-big dried shrimps, strang on bamboo spits

SE of the oddest looking of imported food stuffs in daily use among the exciles of American cities is the big dried shrimp from the rivers of Manchurin. These crea tures are spitted on split humboo—always a sign of oriental handling and on soaking and steaming they enlarge visibly. Their field value ing man steaming trey conserve visinty. Their rises varies is not high, as with a good many other delicacles, in ported or domestic. Still the re night be the green of an idea in this method of preserving for the American flash trade. For example, the Far East usually preserves without sait, by just sun-drying the goods. A Wes

but the flowery republic has been doing it su since the days of Confucius and beyond Salting they reaits. Salt attracts moisture and increases weight, causes the agony of thirst in parched climates, is destructive of som

of the nutritive elements in food, and does not even completely prevent the devel opment of bacterial life Complete saltiess desiccation rgely overcomes these disadvantages kept drv, there can be no putrefaction Automobile tourists who go in for concentrated pro

visions might find useful the compressed rice-nucuroni blocks imported from the trans-Pacific republic advantage over the rice grain is its rapid cooking, brought to a boll it is ready in five minutes. And there is no danger of burning as there is with the straight grain if not watched

This vermicellilike rice product swells in boiling to about four times its dry dismeter, when the threads agour four times its dry answers, when the investment become of benuiful pearly transparency, and print can be read through one. True, it requires a certain amount of practice in mouth gymnastics to negotiate these long clustre strings—but this is a source of actual fun to

Lovers of horse flesh—gustronomically that is to say, not sportively can obtain pure all horse viands in m than a dozen different preserved forms, also, the fresh article. I have handy a few price lists of retail horse but hers the items read temptingly enough, if prejudice can but be overcome. Horse most is remarkably fat free one not "in the know" could not tell the difference between it and Chicago's finest

The flattened and compressed jaeger smoked and dried sausage is the most concentrated of all these rolls dried sausage is the most concentrated of all these rolls of stratery. It keeps will for yearn owing to fit is driess it can be carried lose in the pocket. It is extremely a support of the control of the support for the pocket is supported by the pocket for the control support for the princip cannot be considered for the control strategy for the group be embedded on one of the most fortification of the control of the contr

New York from Delft, in the Neiberlands, which is famed for this product. Those tempting, tressulous colored jellies and blanc-manges made with it are alconvet general and orand-manages made with it are an most exclusively derived in the first instance from the well stewed viscora of "ol' hoss," There is a daily procession into the outskirts of Deift, representing a round up of played-out work horses from neighboring States, especially the British Isles. Of course, all dis-

what look provokingly like dried oxtalis are the strings of "mel'ini" (untranslatable) from Araby the Wolnut kernels are balved threaded with elim cord, then dipped into a batter paste made of wheat ilour mixed with palm or date—or, in the Nile region, the local imfi—syrup. The whole, after repeated dipping,

FROM the huge see slegt of the Ornest, pectured me all his repulsarees me precting hus built mot the upper corner of this box, through all the other team which he illustrates and describes, down to the laeger sausage of horsement that drapes it graceful shape across the adjourning lower corner, Mr. Lodan tells us only of foreign foods that he has sampled, both in their native surroundings and as domesticated, more or less, by the American dealer who calent to the contract of the melon has story quate as miterialized in the sample of the contract of the

is simply sun-dried to the proper degre cake is always obtainable among the Arabiccake is always obtainable among the Arabic-speaking colonies of urban communities in the United States. It is a choice morsel, the nut imparting part of its deficate flavor to its protecting succellent covering. It is dry to handle, having been foured in the num adherder rice flour which, unlike wheat flour, becomes glutinous only by heating

with moisture.

The well-nigh complete constition of strife in the Turkish states is reflected in the re-

turn to American markets of much Near-East food-stuffs. The peculiar little one-pound rose-colored sugar amount and peculiar into one-pound reseccioned sugar-cianes of the heren (refined point sugar with rose fra-grance) affected by the fair immates of the seragio for their tiny cups of coffee or test—this is perhaps the distinct sugar reaching our shores. It has the incon-venience of having to be broken into pieces with a sharp rap from the sugar tongs, to procure a fragment as

equired for use.

Those goat-skin containers full-up — apparently — of

squashed or fattened-out yellow "bananas" are a mys-tery. The outsider would never take them to be the real tid-bit Turkish kalpia or caviar. The fish roe is cured whole and soild, then steeped in beaswax, hence the color and honeyed fragrance of the article. The Paris blevuit-charbon (charcoal blevuit) has been

known these two centuries or more, yet has only been imported to America the past half-dozen decades. It is not a medicated article any more than a whole-wheat biacult would be so considered, but is a regular food blecuit would be an considered, but in a regular food product. It tastes just like the plain unsweetened whent blecuit. The color is an intense jet black—one-third vegetable-charcoul flour to two-thirds whole-wheat flour. The color density of charcoul is such that it does not take much to swamp whatever shade may be asso-not take much to swamp whatever shade may be assoclated with it.

Brillat de Savarin, the brainy jurist and gastronomist of the early nineteenth century, author of "The Physiology of the Sense of Taste," which is translated Paysiongly of the seame of Tarics, "which is translated into many language, has written that it is never well to let others know what you have been eating, through the vehicle of breath doors, "whether vhous, or as a whiff of oranges," and he instances the userfulness in this connection of a couple of charcoal biscuits with a glass of water after ments.

But that is only one use. British medicos indicate

inlies of varier after needs. Common uncertainty minimals of varier after needs. Common uncertainty minimals with the top one use. Drittain nedicos indicate their use in acidity conditions, in preventing beleining their disagreement of the mobile britten of the mobile triten of the

sometimes little more than two-thirds full. This is due to the contents' having been steam sterilized in vacuo at a minimum of heat, after the senting of the vacon at a liminum or new, after the serious of the container, it is purposely never filled, so as to allow for heat-expansion of the contents and thus prevent fracture of the container. Also, the rose fragrance is thus retained in almost all its exquisiteness. For pastry, tarts, etc., the rose confection is added cold at table opening beforehand would dissipate the fragrance container itself figures at table until used up.

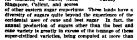
container itself agures at table until used up.
The unique aut peach of mid Asistic countries was illustrated on these pages (Pecember 13, 1919) A western peach-growing specialist obtained specimens of the fruit, planted some of the stones, and now reports that the plants are growing vigorously. In a few year we may expect to see the made-in America nut peach on our markets. This is a freestone peach, always to be preferred to the ellipstone variety with a smooth skin like that of an upple or plum, a weet almost like that of an upple or plum, a weet almost like that of an upple or plum, a weet almost like that of the upple of the upp foreign products, this peach is always obtainable in

This time we illustrate another fruit marvel of the central Asiatic lands—the stone-hard syrupless sugar-It can

central Asiatte lands—the stone-hard syrupus-date This is odorless, non-sticky, yet glossy be carried loose in the pocket it has, like -candy, only an intensely sweet taste The sugar crystallises right inside the fruit on maturity, we show one halved, revealing the white sugar granules. This is the only known fruit that can be used, direct, as a sweetcher. The effect is the same as though one used ordinary refined sugar, there is no fruity or syrupy taste im parted to the drink, only the dif fusion is slower, and the tough date must be broken in two to facilitate matters.
This wild growing date is, un

fortunately, one of the tennelous clingstone variety The pits are sharply pointed on either end and are used by the natives as mull dowels or nails that forms so prominent a fea ture of the outside contour of the ordinary date-stone is not ervable, it occurs only as an almost negligible cavity in the center of the slim pit, contain

These dates are crushed by the ton in the countries of origin, on muturity, the liquor is sun-dried in hollow pans to a hard cake (there is no invertsugar to care for) forming the cheap gur date-sugar of Orien Not deled exitable candied walnuts from tal markets, as Cairo, Suez



20 million n 20 million metric tons. One of the big sugar head quarters in Wall Street has a permanent exhibit of ese other-world sugars

The wild dates are always obtainable at Oriental porters in the prominent American cities. They can grown in our southwestern States, and have the ne grown in our southwestern States, and have the double ability that they can be sold as fruit fresh or dried, or as a direct sweetener. I first came a ross them north of Tankhent a quarter of a century ago, but they are not known to American date specialists, and seem to be a controlled to the con even the Foreign Plants Section of the D

of Agriculture never beard of them The tropical American cone sugar illustratedthe secondent pan-evaporated musculedo-retails today in the Latin American busars at five cents per kilogram in the Latin American massive in the cut by per singram (21 pounds), which is certainly below the cost of sugar in our own markets. This rough, dark brown product is esteemed by the South Americans for use in their strong coffee. It imparts a debetable smooth sayor which refused sugar does not give

The refined white-sugar cones of the Central Eurois an republics are kept out by the tariff with its American valuation, in spite of the favorable exchange In Europe this article retails at about a cent a pound Slugs as an article of diet do not appeal to the west

orld, jet the native Ethiopians relish them as a tid bit A free slug, corresponding in size to the com-mon back vard slug of American garbage heaps, is chopped out of the decayed wood in which it lives, and swallowed alive and whole, with great gusto—it is con-sidered at its lead, thus Of course, on abstract principies this is no whit more revolting than fushion of eating clams and ovsters-it all depends m×m v

The Oriental does not bother with the small slugs he prefers big game in this field. So a sings are his piece de resistance. The sing tribs is a big one. Fur Lastern importers in American cities are never without a large variety of them. Sea slugs range in size from a good-egg to those the size of your hand or ever bigger. The prevailing color of the dried article, the only form in which they are met commercially, is a dingy gray. In fact, they look altogether like the little round droppings of mortar which one may often notice e of a brick wall going up. And they are just let soaked and steamed, they go over into as hard! a delectable gelatinous mass, and make a sustaining broth that has merited their introduction into some of the Australian hospitals, as a builder up for convalescents

of the larger sea slugs is illustrated herewith Dried it is the size of a plump rat steaming about doubles its size. In its desiccated state it has a feeble gelatinous odor, not unpleasant and the color is at most black Contrary to universal custom in evis cernting objects destined for drying for food use these sea sings have the viscera removed through an incision sea sings have the visceral removed inregin in incision running the length of the back which also enables them to be opened out quickly and sin dried. As they dry they automatically close up again leaving a visible silt. On the under side, the rudimentary feet are plainly discornible

Bread Diseases

THERE are several changes which take place in bread which are due to the presence of microorganisms, and which may accordingly be called bread

The first of these ecuveris the bread to suc tion that it can be pulled out into threads. This hread disease is most common. The crumb becomes sticky and colored The most characteristic symptom is that the bread, on being broken, can be pulled out into fine threads. The bread assumes quite a disagreeable odor and taste The must; acid odor can be detected in bak eries, where the disease has been prevalent, many weeks after it was first noticed. The particular bacteria which bring about this disease belong to the potato bacilli group and possess one characteristic in cor



Bread becomes bloody-col-ored due to another bacillus. an extrancis difficult matter ese diseases and to d



kets to become moldy for it is a first rate medium for the development and growth of molds. Various molds can produce various colors in the bread—For example, the produce various colors in the bread. For example, the mold mucor produces a white cohornion, aspergillus glautus a bluish green coloration, etc. Reddish and black spots may also be produced by molds. Neither the molds themselves nor the decomposition products which are brought about by their presence in the bread are deleterious to the health but they make the bread

de-sugar cone of

Latin American mar-

unseemty in appearance and unjunitable.
There are various precautions to be followed in order to avoid the development of these discusses in brend A moderately high temperature is favorable for the Amaderated high temperature is invorance for the growth of the bacteria. Warm brad should be cooled off quickly after baking. The moisture in the bread is also of importance in this respect. Moisture promotes the growth of the bacilli, and hence a poorly baked bread in which the moisture content is high will be bread in which the house of the grans than a well baked bread. The air in the room in which the bread is kept must not be moist. Well baked bread, cooled as quickly must not be most. Well maken breath, concer as quickly as possible and kept in an airc for and not loo warm room will not be subject to these discusse. Of course, the main prerequisite is painstaking deanliness in the baking operation and in the baking rooms.

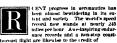
Tests of Tires Made from Reclaimed Rubber THE Bureau of Standards has placed an order with tires using various amounts of reclaimed rubber in the trends. After manufacture, these tires are to be tested in the laboratory and also on trucks of the Post Office Department over four different types of roads, so that the relative wear of the different compounds can be



seed rise-ensearest from China. Conter: Jet black observed bisectin from Europe—a regular food and not a medic Ania, containing plenty of segar but no syrup

With &

Recent Achievements in Engines,



to-coast flight are likewise to the credit of the American Army Air Service Engines on full power tests are now expected to run 250 hours continuously. Gliders re-main aloft for many hours with nothing but air currents and the skill of pilots to sustain them Helicopters have risen vertically, howered over a given point, made complete circuits in horizontal flight. A

Airpinnes have complete Greats in normalin ingut. Argumes much been attached to dirighless while both types of aircraft were in rupid flight. Metal is displacing wood in the construction of airplanes. Pilotless planes carry out complicated cyolutions. The science of nerodynamics is progressed to the actual calculation of the lifting capacity of cambered wing sections, and its art to the design of thick, high lift wings providing relatively im-mense depths of structure for sustaining loads, while maintaining all the elik kney of the thin wings we have been accustomed to thus far Flaps at the rear edge. as well as ingeniously decised slots in wings have at most doubled their lifting (apacity, thus facilitating slow landings.

But out of all this activity a number of things emerge very definitely and three unmistakable lines of achievet in practical aviation appear before us

First, the enormous increase in the endurance a reliability of both planes and motors, as shown by the reliability or both planes and motors, as shown by the const to-const flight and by recent Navy engine tests. Next the wry rapid approach of night flying. Third, the advent of the glider, of which the motorized glider or low powered airplane is the direct sequel

The Const-to-Const Flight and its Lessons

The const to-coast flight is undoubtedly one of the most dramatic achievements of modern aeronautics. most craimate active mens or most in acronautive. The interest and cithulation which it around were country wide, and almost as great as that following the finions flight thes for more practical significance than a mere stant or record. It is a landmark in the development of plane reliability and marks the last act in a

real chronology of achievement
On October 5 and 6, 1922, Lieutenants John A On October 6 and 6, 1822, Hestiennist John A Murendy and Onkley G Kelly, of the Army Alr Service, 15 ing over Inchwell Field San Disco, by the Army, coupleyed with the famous Liberty notor, established an endurance record of 35 hours and 18 minutes continuous flight. On November 3 and 4 the same ms in the same plane few from lockwil 18 tid, crossed the Dockles in spite of ent storms and came down at Schoen Field, Fort Benjamin Harrison Ind. after covering an airline distance of approximately 2000 miles, in a non-stop flight of 27 hours 56 minutes. Their failure to resc the Mantic was due to a leaky radiator, which suc one vinitie was used to least, vinitinot, which such a couragence measures as pouring coffee some and con-densed milk into the water system could not reusely Early in April of the same year, the same persistent pilots but their own endurance records by \$1 mg over McC cook leid Dayton, Ohlo, for 30 hours 50 minutes, when they were forced to land by a cracked water

They then devoted their energies in preparation for a second attempt to make a non-stop cross-continent flight, backed by the skilled efforts of Army engineers and mechanics, taking every precaution both and mechanics, taking every presention both as regards plane and motor. The now historic "F-1" is worth careful study. It is a buse antitiever monoplane of 80 square feet of wing area. The wing also right on top of the fuselage and nothing remains of the numer-con strutt and wire which are generally associated on the study of the study of the study of the latent the study of the study of the study is the study of the study of the study of the internal study of the stu in uniconcess and push form from root to the so that it has a maximum strength near the fuscinge where also the maximum bending loads must be met. Its outer covering is of very thin reneer, most skilfully applied, instead of the usual lines. The body or fuscinge ismude up

the Men Who Fly—I

Practical Aviation, Such as the Coast-to Coast Flight, Better and Arrangements for Night Flying

By Alexander Klemin

Locturer on Aeronautics, New York University

of welded steel tubing. One of the most n of webled steel tubing. One of the most notworthy features of the plane is that the pilot sits right beside the engine. All the engine centrols are thus or the gas, oil or water systems is immediately noticeable. Although the machine was originally engine to engine the gas of the gas o

AVIATION is forging ahead
Aside from such spectacular
achievements as the huge diriibles and their mooring masts of the type here gibles and their mooring masts of the type here shown, as well as the timy low-powered arribanes and gliders, there has of late been a steady succes-sion of remarkable improvements and developments in flying craft We have asked Mr Alexander Klemin, the well-known authority on aviation, to exemin, the well-known authority on avasion, to every for us the outstanding developments in the aeronatical world, and the accompanying article in the result. Because of its length we have found it necessary to publish this article in two parts The second part will appear in our November nuc.—The EDITOR

mad for the cross-continental flight, beyond manning more fuel tanks, bringing the lotal gasoline capacity up to 7.55 jailons, and installing another set of engine and flying controls in the cubin so that the pilots could be accommodately relieve each other Precautions more conveniently relieve each other Precautions taken before the final flight were many, but not in the direction of increasing the strength of the plane or changing its flying qualities. Learning from previous

experience, the pilots took up a quantity of anti-leak compound which could be injected under pressure into

the cooling system, took a spure battery, an extra gaso-line gage, and reinforced all the pine lines. By cutting

Diminutive seaplane constructed by the Cox-Kles organization for use as a scout with submaris Measures 18 feet over all, and weighs 630 pour

out the cabin door and converting it into a sliding they gave the man in the cabin the possibility of stick-ing out almost his entire body into the air for inspec-

tion purposes.

The maximum speed of this plane on official Army The instantus speed of this plane on official Army test is 110 miles per hour. The atryline is often accused of being unconficiel, of consuming great power and want quantities of gandine to error very little becomes and want quantities of gandine to error very little becomes empty, carries a useful load of 5000 pounds and provides for a flight range of six hours, carrying over 2000 pounds of what commercial aviators call "pay 100d"—mil. passegment or Dright—whilet, considering the enormous speeds relative to all other methods transportation, is not negligible. When fully load with its 785 gallons of gasoline for the coast-to-conflight, the machine weighed a few hundred poun above five tons.

Leaving Roosevelt Field, L. I., on May 2 at not

forests and canyons, and in spite of treacherous after current they negotiated a path between the walls of one deep canyon. They reviewed the hanpure of Rock-ies deep canyon. They reviewed the hanpure of Rock-ies are not as the spite of the spite of the spite ing the entire trip. The man who was not actually at the where always found plenty to do in watching paper and instruments, and in loceving the log. The sole and instruments and in loceving the log. The sole in the spite of the spite of the sole of the sole of the little difficulty in hearing induced by the soley rear of the motor. People had lined the whole routs, Pitten-burg, Arrisen, Indianapolis. Twomeneri and Wicken-burg, Arrisen, losing the unit points passed on a reassi-tation of the spite of the spite of the spite of the loss of the spite of the spite of the spite of the spite of the loss of the spite of the spite of the spite of the loss of the spite of the s comed the pilots at San Diego, and telegrams, includ-ing one from President Harding, poured in with con-

are the control of the fight are most important. Apparently the airylane is now ready for commercial air transportation. In all this articles were all transportation in all this articles work, under all sorts of flying vaniditions, in emergency lands are transportation. In the state of the control or instability divers pilots experienced in cross-country work, articular weakness, lack of control or instability divers pilots experienced in cross-country work, there seem to be no insupersible difficulties in naving the state the day or by algebra-although marking towns and other landsmarks, perticularly by light. The economics of the sirplane are not disappointing, and it is ordered that a consecutive and other indemnership the control of the sirplane are not be inverteded to a large extent without serious consequence—a very important factor.

Extraordinary Advances in Engine Endura-

Analyzing the difficulties experienced in all of the successful efforts of these men, we see that the trouble like in the engine, or more broadly in the power plant as a whole

lies in the engine, or more bready in the power plant in which are the above quality control of the control of

It is only very rarely now that a new principle is introduced into the design of the internal combustion angles, or wen a reducta molitarities in its mechanical angles, or with a reductation in its mechanical angles, or with a reductation in its mechanical step, there is continual rediscussed in the state of the test block, there is bette town of material; there is a more correct applications of the state of the state

improve its endurance.

The general character of such changes is very simple, between important. Long crainbalative and crankeness the control of the contro number or cylinders and increase the power of each, thus keeping down the number of parts and also de-creasing the weight for a given power. Duralumin is as strong as mild steel and only weighs one-third as much, and is therefore being largely introduced into eting rods and pistons.

With better cooling and better design for the admis-

sion and exhaust of gas, it is possible to drive engines much faster and to use higher compression ratios. In the old Liberty motor a great source of trouble and announce has been in its lack of rigidity, which in volved frequent water jacket failures, as in one of the Macready and Kelly flights. Standard Liberty engines Macredy and Kelly flights. Standard Liberty engines used by the Navy are now built with Yoo May, Olimber annatum blocks, replacing the old system of twelve annatum blocks, replacing the old system of twelve has been according to the Navi and the Standard develops between 375 and 400 horsepower and weights only 670 pounds. A Liberty motor averages about 72 hours in the air before requiring a complete overhaul,

hours in the air perore requiring a complete overnam, and the Curtis "D-12" stands up to continuous 100-hour runs, without a sign of failure or deterioration. Not only is reliability of the engine important from the point of view of safety in flight, but the cost of the point of view of sates) in light, but the cost of its upkeep is perhaps one of the determining factors in the possibility of aviation on a commercial basis, it is settimated, for instance, that it takes 300 hours to overhaul a Liberty after its average run of 72 hours in the air. The cost works out at \$4.30 per dying hour

of the engine. Other engines recently built, and not quite so re-fined as regards low weight per horsepower, fortunately show even more gratifying results as regards reliability Thus all engines purchased by the Navy now have to stand an endurance test of 250 hours at full power And one particular motor has one particular motor has shown truly remarkable pow-ers of endurance This is the E-4, built by the well-knows Wright Aeronautical Corporation. It is an eight cylinder motor of approxi ately 200 horsepower. which, when tested by the Navy Department, ran consely at full power for 578 hours. During the test.

578 hours. During the test, it would have covered at the usual cruising speed maintained by the Navy seaplanes a flight distance of approximately 50,000 miles, or two and a half times around the equator. The usual high-grade automobile reveals 5000 miles per annum. The new sends acould drive such an automobile bir nine years at 150 miles per hour without showing any weakness or giving any per hour without showing any weakness or giving any

Certainly there is every reason to be gratified by these figures. Offer Mercady and Kelly an engine such as this R-4, part t; into a plane as reliable as the "F-4, see to it that all pipe lines and auxiliary derives of the action feature reliably, and the possibility of trouble in flight with be an remote as that of trouble on a giant transactionate lines.

Possible Use of the Diesel Principle

While engine endurance has increased by improved design along conventional lines, there is possibly a radically different direction in which sirplene engines may altimately develop. The Navy Department in the United States, and the famous inventor Dr Hugo Junkera, in Germany, are experimenting with high-apped internal. in Germany, are experimenting with high-speed internation combustion engines based on the Diesel or sent Plesel principle. The swell-known principle of the Diesel en-gine is the compression of air to pre-sures in the neigh-borhood of 500 pounds per square inth, and admission of this air to the combustion channis rat the end of don stroke simultaneously with the latection of liquid fuel. As the temperature of the mixture is in this case above the ignition temperature of the



Vicuport-Delage racing monoplane, showing the present-day tendency to stream-line every part of an airplane and to eliminate exposed guy wires and cables

fuel no ignition system is required therefore it follows that ignition systems and complicated carburctors may readily be dispensed with Great reliability is thus secured

The Diesel or semi-Diesel engine has a combustion evele of greater efficiency than the usual internal comexcise of greater efficiency than the usual internal com bustion engine, and permits the use of a heavier and less expensive fuel than gusoline. However, the diffi-culty in applying the Diessel principle to airplane use, notwithstanding its reliability and efficiency, is the large

notwithstanding its reliability and edit.lext., is the large amount of compressed air which has to be supplied to maintain the engine cycle.

This involves the use of bulky and heavy compressors Another difficulty is that the Désest is cossentially a slow carine, because the liquid that will not hurry referred to the start of the compression of the compression of the Diese singline ever bulk weight about 69 younds per horsepower, and this is a long way from the pounds per horsepower of the diplane engine. It is possible that the semi-Diesel principle is a more promising line of attack, wherein a hot bulb placed inside the combustion chamber is used to scure combustion at



Low-powered monoplane piloted by Georges Barbot, the French aviator, in which he wen a prime of 35,000 france for a round trip of the English Channel

lower pressures and the air is not compressed to ; sures above 250 or 300 pounds per square inch so that air compression is less of a difficulty. Besides the problem of bringing down the weight and increasing the speed of revolution without cutting down efficiency the speed or revolution witnout cutting down entertucing owing to slow combustion of the liquid fuel, there is still the difficulty in engines built on the Diesel prin-ciple, but of small power, that valves for the admission of the liquid fuel would be extremely small and likely

Both the Navy's experiments and those of Ju-Note the Naty's experiments and those or Junears are at too early a stage for much information to be available, but the conjecture is that both lines of work are on the semi-Diesel principle, with less compressor difficulties to overcome. Many types of this principle

are conceivable A combination, for instance, which readily occurs to the designer is of two firing chambers working at opposite ends of a larger space which night constitute the compressor. It has also been suggested that the air might be compressed inside the combustion chamber, a hot bulb employed, and liquid fuel inject at the end of the compression stroke It is also poss that rotary air compressors revolving at very high speed might well be utilized—a principle already successfull employed in airplane practice in supercharging the et gine to avoid loss of power at high attitudes.

There is no doubt that the application of this p ciple to the airplane engine is fraught with difficulties, but the attainment of increased reliability and efficiency, and the possibility of using cheaper fuel, are well worth

while There is undou here a vast new field fo invention, research and en gineering skill

Progress Toward Night Flying

The most serious hin-drance to the commercial utilization of the airplane has hitherto been the imp sibility of flying at night is only when the airplane can give continuous night and day service that it will surpuss such means of trans portation as are available in the very fast passenger and muit trains serving all the densely populated regions of the United States. So the

problem of night fiving is now engaging universal atten tion, both in Europe and the United States Preparations are now being made on the London to-Paris route for night flying and aerial lighthouses other illuminating devices already make the airway between Croydon, the London terminus, and I vapue, the point where flyers cross the narrow English Channel a blaze of light at night. This airway has been termed the 'Regent Street of Continental Airways.'

In the United States an aerial lighthouse is in opera-tion at Hampton Roads, Virginia, under the supervision tion at Hampton Rouds, Virginia, under the supervision of the Navy Department and the United States Air Mail Service of the Post Office Department is preparing for night flying to begin at about this time. According to a statement by Postmaster General New, there will then be a continuous service between New York and San Francisco, which will cover the interven-ing 3000 miles in 28 hours. Millions of people in the Middle West will nightly witness an artificial aurora boreulis, visible fully 50 miles from its source normal, visione mily 30 miles from 118 source Train will be created by great nertal lights at the five regular fields in Chicago, Iowa City, Omaha, North Platte and Cheyenne Smaller lights, with a visibility of only 30 miles, will be placed at emergency fields every 25 miles along the route. Aviation routing beacons every three miles, as well as ground wind indicators and red lights. to mark buildings and other obstacles at landing fi

year of these extraordinarily careful preparations and the natural advantages of the very level country between Chicago and Chavenne are expected to make this night leg of the service almost as sufe as day fiv-Certainly, Mucrendy and Kelly would have been thankful for even a fraction of these devices installed along the route. There is no doubt that with these wonderful adjuncts, night fixing is entirely practicable and will ultimately be as general as marine navigation by night. If the Air Mail is successful in maintaining lis night fiving schedule, the feut will be one of the historic landmarks in the history of aeronautics.

It is interesting to see how all-embracing the strplans

is in its calls on other branches of engineering and industry. Indeed in the provision of aerial beacons and other night fixing devices a new and fuscinating field of illuminating engineering is rapidly developing ome of these devices merit brief description The very large Air Mail lighthouses are somewhat

different from the shore lighthouses which are used for shipping. To suit the needs of pilots they will revolve their electrical lights of 000,000,000 candlepower on top of their towers, throwing a beam of light three degrees above the horizon and making three complete revolutions every minute. These lights, on grounds of expense, will be operated only when planes are expected.

The somewhat smaller aerial lighthouses, to be placed every 25 miles along the route, will, on the contrary operate continuously. They are constructed on different every 20 mines along the route, will, on the contrary operate continuously. They are constructed on different principles. They have been developed by an American company which is a unit of an international corpora-(Continued on page 284)

Our Point of View

The Return of the Apprentice

THOUGH there is a growing doubt as to whether the good old days were quite as good as we have been taught to believe, there are undoubtedly some respects in which they surpassed the times in which we live. By way of instance, consider the day of the old apprenticeship system and the superb master worknen who grew out of it. Living in the home of his employer, bound to him for a period of years, the lad commenced with the simplest elements of his trade and was required to become thoroughly efficient in one detail of his training before another could be taken up After a period of instruction, frequently lasting for seven years, he graduated as a highly accomplished workman, expert in every branch of his trade. Of the ability of these workmen of medieval times we have abundant est dence in the superb musterpleces that have survived to the present day

Labor saving machinery and our modern fondness for specialization, to say nothing of the tremendous rush of modern competition, have obliterated the indentured apprentice, and with him of course has gone also the highly skilled and versatile artisan Today the ranks of so-called skilled labor are largely filled up with labor which calls itself skilled, but is altogether unskilled, and, as a direct consequence, not only does the grade of work turned out beer no comparison with that of earlier days, but the unskilled and untrained nechanics tend greatly to diminish the output and add Immensurably to its cost

Obviously, the remedy lies in the resumption as far as may be, of the best features of the old apprenticeship system, shortening the period of training and adjusting the system to the conditions of our modern Probably it is known to few outside the field involved, that a most carnest and successful effort is now being made in the building trades to do this very thing, and with a view to bringing this vital movement to the notice of the public Mr Grovenor Clarkson recently invited a large company of editors of this city to meet the representatives both of employers and of labor at a luncheon, and learn from them what has been done

The elimation of today as outlined by Mr. Buet L. Fenner, President of the Apprenticeship Commission, is that in nearly all of the skilled trades the supply of skilled mechanics has declined until there are not more than 60 per cent as many available in many trades us there were ten veurs ago. Some skilled mechanics, it is true come over from Europe, but for twenty five years past the number has been practically negligible Hence we must depend upon our own efforts, and edu cate our American boys for the skilled trades. The Commission has put in operation a system which aims to give the apprentice a thorough and well rounded course of training the bulk of the instruction being given in the shop or on the job It has been arranged that while the joung man is learning "how" on the job, he shall learn "why" by attending some form of training school In this respect, the Commission has met with the enthusiastic support and cooperation of the Board of Education Well-equipped classro and teachers have been supplied courses of study have been outlined and have been adopted, and ample funds have been provided. It angurs well for the solution of this great problem, that not only the employers, but the labor organizations also are giving the new system their heart) support Incidentally, Mr Fenner drew attention to the fact, that under the prese method, American boys are being brought up to better citizenship, since the seeds of radicalism and discontent can find no congenial soil among the ranks of highly cessful and skilled craftsmen.

Speaking for the Chairman of the Board of Education, Mr Rugene Gibney drew attention to what he aptly called "The recent democratisation of higher education" which makes possible for every citizen a high t) pe of intellectual training. The humble parent would like to see her son in the professions, yet, now that the trowel is earning more than the pen, there is a mad rush to escape the white collar brigade. So the school was called in to develop a vocational training that should turn out in a month a bricklayer or a plumber This has been regulated, and the proper balance is now being found in giving the apprentice his intellectual equipment in the classrooms, while he is acquiring experience and skill during his day's labor on the job.

Crewless Airplanes

IIK crewiess airplane, as its name implies, is flown without a pilot. Its central, as to height and direction, is effected by means of radio impulses sent from some point outside of itself So far as its central is concerned, the muchiis in the same class as the radio-controlled torped and it is subjected to somewhat the same limitation It will be remembered that the earlier attempts to produce a radio-controlled tornedo called for such control to be made from the shore and, as we pointed out in those earlier days of experimentation, the range of the torpedo was limited by the range of vision and also by the fact that it would be impossible accurately to steer the torpedo if it moved very far from a straight line drawn from the observer to the torget. The same inherent conditions of the problem would render it difficult for an observer placed in some fixed and distant position to direct a crewless airplane against a ship at sea, or any definite object such as a machin gun nest or a battery. In fact the problem will be further complicated in the case of the airplane, by the fact that, since it is in the air and the observer on the ground, he can never be certain, as he straight ons out the air plane for the final dive, that it is pointed directly at its target-consequently, it will robably strike short of or beyond the target

Hence, to direct by radio a torpedo, a crewless torpedo boat, or a crewiess sirplane, with sufficient accuracy to make a direct bit on a definite target. It is necessary that the radio control be exercised by a piloted similane which flies above the torpedo, and above and behind the crewless sirplane Pot-lack shooting is never profitable, that is to say it is rurely worth the expenditure of time and materials. The crewless airplane, for in stunce, if loaded with a heavy charge of T N T and directed from another machine, would be a deadly weapon for the destruction of bridges, ammunition dumps and a variety of other military objectives, but to send a fleet of these machines into the air, dispatch them, unattended, over the enemy terrain, and cause them to dive for the final blow, would be very haphazard work The same amount of high explosive fired from heavy artillery would, in our opinion, do much more effective work. The radio-controlled torpedo is intended to be steered from the air, and we prosume nothing less than this is contemplated in the use of the crewless simisms

Prevention of Automobile Accidents

REPORT made at the last annual meeting of the National Highway Traffic Association opens with the statement that during last year 14,000 lives were lost in this country in automobile accidents. The present registration sh that there are in the United States 12,000,000 vehicles, and the manufacturers estimate that the increase this year will be 8,000,000 additional. The report says that the risk to safety lies in the fact that 90 per cent of these vehicles are congested upon 10 per cent of our roads. Fourteen recommendations are made by the Committee, all designed to reduce the ghastly slaughter which is now going on, and which, unless something is done to check it, will continue to increase.

The more important recommendations come under four heads, first, to secure good designs for new roads, second, to promote adequate improvement of old roads; third, to insist upon reconstruction of existing roads at places which have proved especially dangerous, such for instance, as grade creasings and approaches to bridges, and lastly, to improve the location of the center line on dangerous curves and elevations. Particularly urgent is the call for standard practice throughout the country in respect to the location of danger signals. the elevation and banking of curves, and the widening of the roadway with regulation of traffic on curve On the completion of transcontinental routes there will be an increase of interstate traffic, and when a driver passes into a new section of the country, where the regulations, signal posts, etc., differ from those in his own State, he is liable, without intending it, to break local State rules, thereby becoming a danger both to himself and others. Hence, the need for standardized rules, and so far as possible, standardised constructions from one end of the country to the other

Perhaps the most important recommendations of all are those which have to do with curves on resilvery and the approaches to them, and particularly the suggestion that there should be cleared away whenever possible, all stone walls, underbrush, trees, banks, etc., on the inner side of the approach, so as to make it possible to obtain a sight of the other approach at a distance from the curve of at least 500 feet Furthermore, the curves should be banked as a protection against skidding and to assist the driver in keeping within the limits of his own half of the road. It is recommended that this superelevation vary from nothing for a three-degree curve to one inch per foot of width for curves of twenty degrees or sharper Furthermore, on all curves of more than four degrees the navement should be widened on the inside one-half foot for each one-degree increase in curvature, and the widening and banking should start at a minimum of 50 feet before reaching the beginning of the curve. Another important recommendation is that a line about four inches in width should be painted on the center line of the pavement on all curves. Furthermore, notification of all sharp and dengerous curves should be given. hy sign, about 400 feet from each end. Another recom mendation, aimed at one of the most dangerous practices of the inexperienced or careless driver, is that the traffic code should contain a law to the effect that the attempt to pass a motor vehicle, if going in the same direction on a curve either horizontal or vertical. where the unobstructed line of vision is less than 500 feet, should be made a mindemeanor. Another important provision for insuring that danger and precaution signs shall attract the eye, calls for the elimination of all advertising signs except those erected by direction or permission of the highway officials.

The adoption of these suggestions of the National Highway Traffic Association would go far to cut down the annual toll of fatalities, and we recommend them to the careful study of the various State highway officials and all owners of motor cars. They would impose no hardship on the motor-car owner, at the e time the safety of travel on our public highways would be assured.

Limit of Size of Ships

T THE meeting of the International Navigation Congress held last month in Londo there were two subjects of major importance and closely related to each other, which were dealt with in no less than seventaen reports. The two outstanding questions were the present and future size of ships and the nature and cost of the dock accou modations which must be provided for these, layman who may read these reports will come to the conclusion that the factor which will control the size of future ships is the rapidly growing cost of the or roune sains in the rapidly growing cost of the dredged channels, piers, dry-docks, etc., which must be available for them at the ports of call. Were it not for the difficulty, risk, and cost of han-

Our Point of View

terminal ports, we see no reason why the dimensi of future liners should not continue to increuse Contrary to the popular impression, it is a fact that during such a busy summer season as this of 1923, ships like the "Levisthan," "Mujestic' and "Aquitania," in spite of their beavy overhead charges, are able to show a satisfactory profit The trip to Europe, despite its cost, reveals no signs of losing its popularity, for s-Atlantic travel is growing steadily The enor mous increase in wealth due to war profits has placed the luxury of a trip to Europe and travel on the continent within the reach of a large class of people, who before the war would have looked upon it as a great extravagance So long as there are sufficient trav who are willing to pay from \$500 to \$5000 for their accommodations, hig ships will be a profitable and attractive venture.

We well remember the sensation which was produced when Dr White, the Chief Constructor of the British Navy, predicted that we should see a 1000-foot ship upon the ocean At that time the largest vessels we "City of Paris" and the "City of New York," each 500 feet in length Today, in the "Leviathan" and the "Malestic," we have practically reached the 1000-foot ship, and he would be a bold prophet who affirmed that this was the absolute limit Thus, among the paper read at the International Congress above referred to we find that Sir Cyril Kirkpatrick, Engineer in Chief of the Port of London Authority, considers that vessels over 1000 feet will be built, and recommends that the entrance locks to the berths intended for the largest ships of the future should be 1100 feet long, 130 feet wide and 45 feet deep over the sill. He recommends the same dimensions for future dry-docks, with the floor four feet lower than the sill to permit of facili tating repairs, on disabled ships. Mr F Wentworth Shields of the Port of Southampton stated that those who had to deal with the situation at the port frequented by the largest liners were most anxious to w whether owners and builders would eventually set aftest ships of 60,000 or 80,000 tons. According to this, and other authorities, the limit of the size of future ships should be set, not by the ship builders or owners but by the dock owners, who would demand an increased rate per ton for the dock accommodation of the larger ships. He tells us that to accommodate a ship drawing 40 feet, which is the maximum draft of the "Leviathan" and "Majestic," costs \$1,000,000 per ship berth and that a berth to accommodate a ship drawing 50 feet would cost double that amount per berth One authority at the conference stated that the cost per berth would increase as the cube of the druft of the vessel that lay alongside that berth

Now, although it seems filely that the Increase in intractasis travel, and the Increased capacity of such travel to pay very high prices, will favor the construction of abigs of 1000 feet or over, we are fernly of the conviction that, unless some cheaper method of dork construction can be developed, the 50% feet inquit, 100 foot the limit of dimensions for future large passenger liners.

To Bridge the Golden Gate

country has been approached of late with the request to give a tentative estimate of the reply, they have no harding arrows the olding arrows the country have the entrance to San Francisco harbor reply, they have not hesitated to state that, in pile of the great again of 4000 feet, the design and construction of such a bridge is feasible. The difficulties of the project have been these of politics and finance rather than that of angineering, but recently the California Legislature has authorized the counties to issue bonde for bridge and highway work which they may jointly wish to put through. This removes the difficulty due to the fact that the bridge would join two different

counties, and now that this hindrance has been removed, a Committee has been formed for the construction of the bridge, and the city enjmey has announced that a 4000-foot agan will be built across the Golden Gate for \$2,000,000

As with the Hudson River Bridge the outstanding ems are rather those of finance than of engineer It would be quite possible to bridge this great between the headlands at the Golden Gate with a span that would carry any load which might be im posed, not merely by the traffic demands of the present but by the inevitable growth of truffic in the future The limit of span for a cuntilever bridge is about 2000 feet, and hence the structure would have to be of the suspension type Now for a suspension bridge, not even 4000 feet would be the practicable limit, for the engineers who have specialized in long span auspension bridges will agree with the statement of Mr Lindenthal that, considered merely as an engineering proposition, it would be possible, if there were a call for it, to build a suspension bridge of 5000 feet clear span, that would be perfectly stable and enduring

The estimated cost of \$25,000,000 seems low for a bridge of this magnitude, and if the city enducther has been correctly quoted, it would look as though the city were building too much for the present need and with too little exacted for the growth of traffic both rail and structure is extended by the control of the structure is extend to promote it is no fifth uit and costly undertaking to increase the capacity of a sus pendan bridge once it has been completed. Analoguities will arise as to the exact distribution of the streams between the old and the new work, and the probabilities are strong that enlargement and reconstruction will havolve a sucribe of the articles appearance of will havolve a sucribe of the articles appearance.

Anti-Railroad Propaganda

IONSPICUOUS among the great institutions and industries of the country which stand out head and shoulder above all others is our vast railroad system. Without a doubt transportation is the basis of our modern industrial life Let us never forget that Hence, any plot against the railroads is a plot against the country, for if the victous propagands, which is now being carried on against the railroads, should succeed the whole system will be threatened with disorganization and bankruptcy If this should happen, the disaster would embrace not not only those who have invested their capital and say ings in the railroads, but the great army of railroad employes and their families. Today the railroads of the country employ about 1,800 000 people, including more than 20 000 officials, and if we take the commonly accepted average of five to the family, we arrive at a total of nine million people whose wellbeing is directly tied up with the prosperity of the railroads. A large and increasing number of these employes are holders of railroad bonds and stocks, and if we add to them the millions of people outside of the railroads who have invested in railroad securities we shall find, probably, that the interests of about one-fifth of the American people are closely bound up with those of the railroads.

The propagatidits of the country, bender by La Polistic, are trying to great allowed the fiction that the railroads have placed upon their properties a feet titious valuation which is about to billion dollars greater than the exact value. The railroads are seeking to have merely a fair valuation placed upon their properties, and they sak that the Internate Commerce Commission treat them in secondaries with the countries of the Constitution as interpreted by the courtry. In a question of the whole country. The question of the whole country are questioned to the properties of the whole country. The question of the secondaries when more design will article a how at the railroads even more design than that with which they have ertipoid our American Marchan Marine.

There is no doubt that the railroads are today sufforing from the "sing of their fathers", but the abuses of relating, unlimited free passes, etc., have long passed away President Roosevelt did an excellent thing, n only for his country but for the railroads themselves, when he advocated the formation of the Interstate Commerce Commission In the earlier years of its existence, this body did very fine work, later, it began to take on something of a political color Today, however, we believe that the Commission is sincerely wishful to give the railroads a square deal. In this effort, particularly in resisting the anti-railroad propa ganda above referred to it should receive the hearty exoperation of the country acting through its accredited representatives in Congress The situation is so serious as to call for immediate action

How Fast Shall We Travel?

N CONSIDERING the question as to what will be the speed of travel in the immediate future, we must remember that it is easen tially one of economics, for the cost rises more rapidly than the sweet especially in owen travel. and there is a limit to the price the public will pay So far as ocean travel is concerned the question we answered in an article in our issue of April, 1923, by Dr. brost hourster, in which he showed that to rules the speed of the "Leviathan" to 28.35 knots sea-speed would necessitate an increase of her horsepower to 185 000 horsepower, and that her length would have to be increased to about 1000 feet and her beam to 110 feet. He showed further that to secure a 33-knot vessel, the length would have to be 1120 feet, the beam 147 feet and the horsepower 380,000. Hence, it was concluded that if we wish to cross the ocean at a speed of over 25 knots, we must do so in a trans-Atlantic air liner

With rigard to travel by rall, the indications are that of miles a hour will be the maximum speed for many years to come. The fastest train in the world today, years in come. The fastest train in the world today, travelling on a ravalur schedule, was placed in service on Iuly of this year on the Great Western Ballway, Engined. The new train runs between Cheltenham and Proddington Ba_kland, and its maximum speed in obtained is tower Newmon and Publington, a distance of Ti's article, which the time-table requires to be constanted in the control of the cont

The railroad systems of the United States has no train scheduled to run so fast, although the speed is approached during the summer season between Camden and Atlantic City It would be quite possible, with our more powerful engines and in spite of our heavy trains to run trains at 60 miles an hour, but of late years it has been the policy of the management to reduce the speeds of our fastest express trains. It will be remembered that, twenty years ago, the New York Central and the Pennsylvania Railroads instituted the famous 20th Century trains, which ran between New York and Chicago at first in 20 hours and subsequently in 18 hours. There was a heavy penalty on these trains if they were late on arrival, and the engir were under orders to make up any lost time as quickly as possible. This they invariably did, and some very fast rupping was done

The writer traveled in the cub of the New York Control's 20th Century train for most of the distance from New York to Chicago and back, and by careful activation of the Control of the Co

Our Abrams Investigation—I.

Some Preliminary Impressions Regarding the Electronic Reactions of Abrams

By the Staff



HK WORLD is face to face with a new riddle Under the name of the Electronic Reactions of Abrams, or E R A for short there has come into our midst a new method for the diagnosis and treatment of dise which is revolutionary in its claims indeed on its very face this method virtually ridicules established medi-

cal science by putting diagnosis and freatment usen just as positive a basis as the measuring of an electric generators output or the location of trouble in an electric circuit. All of which is of first importance to the human race, if true, and therein lies the riddle.

The E R. A has its staunch advocates Ever since Dr Albert Abrams of San Francisco reported his dis-Dr Ausett Annams of san Francisco reported ins dis-covers of certain radio-active properties of blood and worked out his revolutionary method of diagnosis and trainmant, doctors from far and wide have displayed the keenest interest in the E R. A. Many have gone to the Adrams chile in Nun Francisco thort to learn the new method from its founder the new method from its foundar. Some have come away convinced, and have set up Abrams clinics in various parts of the country. Others have been un-convinced from the very first. Still others have prac-ticed the Abrams method for some time, only to repudi-Some have come And still others have started out with the original Abrams method and have then devel oped their own version of the electronic reactions, so that their work today cannot be considered typical of

the Abrams method
The advocates of the K R. A are not anting for arguments in substantiation of their claims. They can eite case after case of remarkable diagnosis and still more remarkable cure. Even the dreaded cancer has been successfully treated and cured time after time by the Abrams method, so we are assured

On the other hand Dr Abrams and his followers have by no means proved their case to the full satisfaction of the medical world, so we are told by the skeptles. Fine and again, it appears, Dr Abrams Fine and again, it appears, Dr Abrams has been afforded the opportunity of put-ting his method to a conclusive test, and he has failed to do so. Investigators who have looked into his methods have as often as not made the most unfavo orten as not made the most unfavorable reports, particularly as regards the so-called electronic apparatus of Abrams. The method has been attacked in such popular periodicals as Ford's Dearborn

Independent and Hourst's International Magazine A vigorous compaign against Abrams has been conducted al of the American Medical Association which has been reporting the demonstrations and results of Abrams and his practitioners in a rather caustic

To offset the attacks of the skeptics we have the laudators comments of prominent men and women, mostly writers and journalists—whose word means little in the realm of medicine, of course—as well as the campaign conducted by Pearson's Magazine, which has complete the control of the control sufficient faith in Dr Abrams and his method to have

is in a quandar, and stands by, waiting for the final

At this point the Scientivic American, u large volume pool (or evasive), assessing, light by large volume of correspondence regarding the E. E. A. which has been reselved during the past few months, has entered the controversy not to take sides but to act as an independent investigator. If is our intention to listen to the arguments of the believes and the skeptics, review alleged cases of cure as well as alleged cases of failure to cure, conduct a series of tasts with the Abraus method of diagnosis and treatment, and undertake a critical examination of the apparatus employed. All the while, of course, we fully resilize that the medical world and the public at large, as well as the SCEEN-TIFK AMERICAN, are justified in their rôle of skeptics the burden of proof rests absolutely with Dr Abrama

and his followers.

Our preliminary investigations have had to do with an electrosic reactions practitioner in New York CHV whose work it based on the Atenua method We have been been approximately an experience of the present of th numerous switch-points, one bank of switches represent d of all ing the quantitative analysis or brain or alliment and the other the quantitative analysis or degree of alliment Electronic currents are caused to flow through the colls of the "dynamiser," through an amplifying device, through the specimen, and through the healthy subject

the vast public interest in the Electronic Reactions of Abrams method of diagnosis and treatment, has undertaken a thorough investigation of this highly controversial matter. It invites its readers to send in suggestions for tests, to give the names and addresses of Abrams clinics and practitioners. to relate their experiences with Abrams practitioners, and to give the SCIENTIFIC AMERICAN the full benefit of their knowledge of the subject.—THE EDITOR.

THE SCIENTIFIC AMERICAN, fully cognizant of

reactions of the human body. The most con reactions or the numan body. The most common method, however, is by percussing the abdomesn. Fercussion is to some extent a lost art, and few physicians have the necessary skill to recognize the dull area, so we are assured by Abrams advocates. The usual manner of are assured by Abraias advocates. The usual manner of porcussing is to pass the middle finger of left hand over the abdomes, but not in actual contact. The separation is as small as possible, governly one-eighth inch All the while that finger is thumped with the middle finger of the right hand, which is provided with an ordinary celluioid thimbie weighted with lead shot and war to cellusing thimble weighted with tend short and wax so as to make an all but perfect contact with the end of the finger Normally, percussion indicates a region of the abdomen where duliness begins. When certain "vibrations" are permitted to flow through the "dynamizer," if present in the specimen, the region of duli-ness drops noticeably below normal. Then the quanlitative switches are brought into play and resistance is presumably added to the electronic circuit until the area of duliness has receded to normal. A reading is

neat tases in came.

If the patient is present in person, the specimen is dispensed with and the patient reacts directly to the qualitative and quantitative adjustments of the "dynamiser," which, truth to tell, is a considerably more logical procedure.

logical procedure.
The apparatus employed falls to convince a inchal-culty inclined person. We have been privileged to take apart a typical electronic rescribes machine for disp-apart a typical electronic rescribes machine for disp-lations of being in the form of true coils, the fine wire, apparently German salver or mane other kind of resis-tance wire, is compared bits shapeless masses. The arrangement is quite simple, but we are informed that

the coils have to be figured out with a great deal of care There are open stretches in the wiring arrange-ment, but again we are told that the circuit is an elec-tronic circuit and not an electric circuit with which we

are more conversant. Indeed, there are many, many binare things about the Abrams method and its application. There are claims mude for it which on their very fine sound ridiculous—even the Abrams practitioners themselves modit with a smalle that such claims are unbelievable until proved. One which struck us particularly so its at diagnost can be conducted with nothing move than a scrap of paper or which the patient has shapiy drawn a scrap of paper or which the patient has shapiy drawn a line with a load peace! The desired contains at his day of the control of the contr ime with a lead pencil! The electronic emanations or ne body mingle with the graphite and remain on the paper! In our next issue we shall endeavor to make a formal report of an acid test of the Abrams diagnosis, under-taken in such a manner as to precipide all possibility

of prior information or happy guassing

A Gas Mask for All Gases

A team Massix for A.I Genore

IN a recent "Technical Paper, 500," by S. E. Kats,
I. J. F. Ricomboid and A. C. Fleidberr, or the Departman, and the state of the Pe experiment station

neat station. The army gas mask as developed during the war gave protection against all the polanonus gases, vapors and monkes excountered on the field of battle. But when, after the war, army-type gas masks were advocated for use in metallurgical, chemical and other industries where non-time these or furness course the Burners of these contracts there are furness course. ious buses or fumes occur, the Bureau of Mines immediately pointed out that these marks give no protection against ammonigas used in refrigerating plants, or again carbon monoxide, a constituent of blast furnace gas, producer gas, water gas and rurnace gas, producer gas, water gas and coal gas. Recently, special gas masks having canisters containing absorbents designed for protection against summonia or from carbon monoxide have been developed, but these afford little or no protection against other gases. To combine efficiently in one canister the absorbants for all noxious gases is difficult because the absorbents for certain gases are best when moist, whereas an aba rbent or cata-

when most, waseress an assorted or extended the perfectly dry. Hence it becomes necessary to use dry hastretests for the other cases, and consequently to develop new absorbent for these gases which work satisfactorily in this condition.

natificationly in this condition.

After an extended series of experiments by the Bureau of Mines the "insiversai" gas mask was developed. The cansister contains aromalies abortions aromalies abortioning of activated charcest, for removing organic vapors, a filter or cutton would for removing mobiles, dusts and indistring a continuation of the contract of the cont

igh about 8½ pounds. Masks of the universal type are useful for em Make the of the mirrors have a weekl for conception and proposed around chestical plants or the like in which many different gases or vispors may be met. They are sepecially adopted to the work of off the flagstone, who exceemise all binds of poisonous gases. Slowers, gas expectably adopted to the work of off the flagstone, who exceemise all binds of poisonous gases. Slowers, gas expectance and the proposed contracting the proposed contractin

The Six-Meter International Cup Race CLAMS racing by small yachts of 20 to 30 few waterties length is becoming increasingly popular, a fact which is full of provide for the future of this, when yacht racing, and particularly international cup racing, was of accessity a rich man's sport. In proof of this we have only to consider the great zeries of contests for the America's cup, when the task of demeant the expenditure of several hundred thousand dollars. Purthermore, the sailing of a 90-footer is mainly a probacolomical's bob, with a lightly paid ceptain analys a growheadcan's bob, with a lightly paid ceptain mainly a first continual to the case of one shift, the "Wigilins," came to over haif a hundred men.

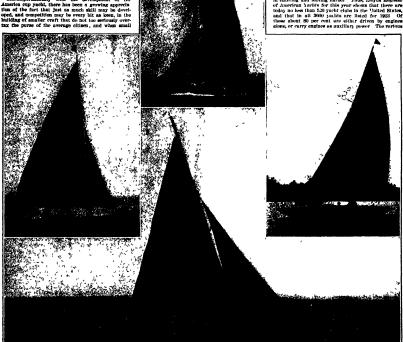
hundred men. Contemporaneously with the development of the America cup yacht, there has been a growing appreca-tion of the fact that just as much skill may be dwel-oped, and competition may be every bit as keen, in the building of smaller craft that do not too seriously over-

hundred men.

"Six-Meter yachta." These fine little craft are designed according to a rule which absolutely shuts out any freak designing, and produces a normal boat of mod-erate sail spread, that is fast in any weather from the lightest wind to a breeze which calls for the tying in

of recin.

Before passing to a consideration of the races of 1923, we wish to give some facts which show how remarkable is the present revival of yachting, and to point out what a great influence the internal combustion motor has exerted in populariting the sport. Not only is the fieed of bonts that are propelled entirely by only in the fiest of boats that are propelled entirely by internal conductive engines exceedingly large, but the sport has been greatly asolated by the practice of target in the property of the property of



Top conter: "Lea" (American), 28 points. Left: "Colla III" (British), 39 points. Right: "Reg" (British), 32 points. Lower: "Clytic" (American), 27 points.

boat recking began to take on an international flavor, with all the computitive landment to which it appears with a single property of the property of the property of been given to it in all its long lateray. Furthermore, it now became possible to dispusse very Furthermore, it now became possible to dispusse very Agraphy, if not singeptise, with the services of paid pro-tagates, and incident firmulation of the property of world, a race of manteurs who can hold their own, both at the wheel or in the handling of the satis, with the just of the prophesical men.

Anomer influence which has been most potent in the promotion of yachting was the great war, with the subsequent high rate of wages demanded by the hired hand. This, coupled with the great first cost of a yacht, has rendered it practically imperative that the owner should depend upon himself and his yachting friends for the crew

friends for the crew

Among the many cups, National and International,
which are now being raced for year by year, none has
attracted so much attention, or produced such excellent
competition as that between what are known as the

Meets of the present year also have shown what a great bold the sport has taken upon the American during the recent Larchmont race week, and, leighing from the number of new boats that are planned for next year, it is evident that he senson of 1264 will.

The first international content for the cup offwed for atk-meter boats took place in littles waters in 1921. The majority of the mees were sailed under the condi-

THE PROPERTY OF THE PARTY.

microscope with micrometer measuring inch, used for measuring identification marks, blood corpuscles, etc.

REQUENTLY a homicide case rests pri marily upon the question "Was the mor-tal bullet fired from the defendant's gun?" For many years, in a large number of cuses, conviction after conviction has occurred because the methods used to an swer this question, accepted by prosecuting attorneys.

the court and the jury as sufficient and convincing, have been faulty. The defendant's attorney has been prevented by lack of funds or lack of knowledge fro adequately examining the possibilities of error

There is a certain rigid scientific procedure which should be applied in all cases involving the question should be spilled in all cases involving the question whether the nortal builter passed through the defendant's gam. All identifying unries must be observed and securise measurement made that show the caliber and securise measurements that the size of the style of version through which the builter was fired style of version through which the builter was fired bearing constantly in mind that these identifying marks cannot identify individual guns that fired fatal builters, see from earrors have been made in gards game by, through belief that identification marks that almoy indicate the ceilliter and the manufacture point actually to the ceilliter and the manufacture point actually to the particular gun of the defendant.

One of the greatest mistakes in the past has been

the assumption that a rust spot or corrosion, either in a groove or on a land in the barrel and remote from the muzzle would mark a bullet so that it would be recognized as a mark of identification on this particular The marking of the bullet by pitting or cor rosion within the barrel is of practically no value in determining the gun that fired it. Hundreds of experiments have been made by firing bullets through new guns from the factory and the bullets have been

found to be scored as muas in the case of guns with rusty or pitted burrels. When five guns are selected, four of which are new and one old and rusted, and the firing test is made, it is im-possible to distinguish be-

tween bullets,
Properly, the first ques-tion is whether the bullet is used in revolvers, pistols or used in revolvers, pistois or rifles. It is then possible to determine the make of the gun, pistoi or revolver as the case may be. The first marks of identification are marks or identification are useful simply as a prelim inary to the next problem. The exact width of a land and a groove has been deter-

Practical Criminology at Work Some of the Adventures of the Scientific Modern Detective

By Norman G. Meade

mined by proper and exact methods, but the next step in to measure all of them consecutively at the muscle and from the right to the left around the barrel. It will be found that the grooves and the lands vary measurably in width due to unavoidable inaccuracies in the cturing process.

manutacturing process.

The first thing, therefore, is to determine whether
the mortal bullet was fired from the defendant's gun
and if the marks were made by the rifling at the muscle
of his gun. The measurements around the muscle of of his gun. The measurements around the mustle of the gun showing the width of the lands and the grooves will correspond to the marks on the bullet if it was fired from that gun. The final marking of the bullet comes from the nugsile of the gun and any marks or measurements in the center of the barrel or at the breech are of no consequence in the test. Near the base of the bullet, which is last to leave the muzzle, will be found the markings corresponding to the gun from which it was fired, and these have to be measured accurately also Measurements of the gun and the bul le microscopicalis beginning from a certain point and following around the barrel at the end. A set of measurements of the bullet laid out to a large scale can be revolved on a similar set of measurements of the mussle of the gun and if there is a variation or the musice or the gun and it there is a variation of even one measurement, there is a suspicion that the bullet came from another gun, and if there is a varia-tion of two or three measurements, it is almost con-clusive evidence that the defendant's gun did not fire the

It often occurs that at the rim of the bore there is some actidental mark such as rust or a bruise which causes an elevation of the metal. These musile condicauses an elevation of the metal. These musaic condi-tions leave certain marks or extractees on the bullet, and if the morial bullet corresponds to these marks, and to the measurements of the test bullets, only then was it undoubtedly fixed through the same gun. These are a few things to be observed and avoided, otherwise an innovent person might be unjustly convicted, due to lack of appreciation of scientific facts

ow a criminologist goes about his work of accurately checking up the conditions surrounding a homi-tide case is well illustrated by the work of Albert H Hamilton, the foremost microchemical examiner and criminologist in the country, who has figured as an expert in about one hundred and sixty murder cases all parts of the country, as well as hundreds of civil cases For example, a few years ago Elmira, N Y, had an epidemic of burgiaries and the city seemed to be infested with porch climbers and keyhole artists, although there was an excellent police department. The chief of police and the chief of detectives broke in upon two suspects in the room of the latter, and were killed in the resulting gun fight. One officer had been also in the resulting gan fight. One officer had been shot once and the other twice. A search of the neighborhood was made and a man found hiding in a cellar stairway. Ills log was fractured, and his 38-cullber revolver contained two unexploded and three exploded shells. Identified as one of the occupants of the murder room, he was subjected by the detective bureau to the third degree, which resulted in his giving his version of what spired from the time the officers entered until his capture. The primaser told who carried the gun and did the shooting, which officer was shot first, the order of the shots and why the officers were unable to draw their own guns. This confession was of no value with-

out corroboration, and the detectives waited for Hamilton's report of his findings.

In preparation for a microscopic deductive examination of the room, Hamilton empirical himself with a special microscopic, measuring devices, chemicals, drafting instruments, chemical blood reagents and rubber of the door, he made glows. From insuediately inside of the door, he made glows. From insuediately inside of the door, he made lower than the contraction of the contraction o be located to spatter the blood where found. He then reversed this preliminary process and traced the steps from where the bodies were first wounded to where the large spots showed that they finally rested It was determined that the first shot was fired when

It was occurrenced that the mrs anot was mrs when the officers were just inside of the door, but so far there was nothing to show the order in which the shots had been fired, or which had been fired first. The three builtets removed from the bodies of the slain officers at the autopsy were examined by Hamilton and found to be of three different makes. Examination of the rear of the cylinder of the mortal gun showed that the first and second cartridges exploded had contained the next and second currindess exploded had contained the bullets found in the chief of detectives, and the third and last bullet had entered the body of the chief of policy. The first bullet wounded but did not kill the chief of detectives. The chief of police had on a derby last, and his head was held down other by himself or the burgiar who was not shooting. The fetal shot went through the top of his head into the brain and the officer fell, as shown by the large blood hemorrhage. In the pocket of the explared burglar there were a number of J8-calliber cartridges of two different makes which curresponded in age and appearance to those found in the evolver. When Hamilton's work was completed, his report was submitted to the detective department and showed a startling corroboration of the story of the printeger, of which he had remained in ignorance. It ficer fell, as shown by the large blood hemorrhage. In had checked up events in the room so accurately that the prisoner was sentenced to life imprisonment

Cases frequently occur where suspicion points to a person as guilty of nurder where, in reality, the siain person as guilty of nurder where, in reality, the siain person was killed by a self-inflicted wound. Certain definite steps are taken to prove such conditions, and may be well illustrated by a suicide case a short time

sall village in eastern New York, where the in a small vininge in easiers, new York, where the principal industry is the insunfacture of cotton and woolen goods, there lived a young man and his wife, to whom we will give the name of Brown, Living with the young couple was an aged uncle of Mrs. Brown, feeble and in poor heulth. He had no occupation, but through thrift in his earlier days had accumulated through thritt in his earner days had accumulated some money, which was deposited in a local bank Mr and Mrs. Brown were employed in the mills. The uncle contributed a small sum at stated intervals toward his support and was cared for tenderly by the young people.

support and was cared for tenderity by the young people. One morning he uncle was reported as having been found alore by Howen, and Howen was reported by the neighbors as having acted magiciously immediately beneghbors. I having acted magiciously immediately beneghbors as having acted magiciously immediately believing a black mark, the revolver was found served for the control of the control o

oner with instructions that it should be carefully pre-served without washing or an application to any part of the body Investigation of the financial condition of the young couple and the old man showed a plausible

old man showed a plausible motive for murder. The coroner, the district attorner and the county de-tective had been long in the service and all were experi-enced in the handling of suicide and homicide cases. To these the detectants. To them the defendant's alleged "conscion-



Checking up a weapon against the scars that it produced

sible miscarriage of justice, for innocent people often sible mitearrange of justice, for innecest people of the behave in the same enames as guilty ones. They knew that it was possible for a person trained and skilled in the sankpis of gun-slot wounds and veryons to examine the body, the weapon, the ballet and the con-ditions surrounding the death of the victim and deiter mine whether murder had been done or death was caused by the victim's own hand.

Therefore, the body was subjected to a critical examination by Hamilton, which was short, for he knew at cases where to look and what to expect, no matter whether the victim committed suicide or was nurdered. whether the victim committed suicide or was nurribored. He first examined the wound at the entrance and dis-covered small grains of black gun proder in the cycle of the bole in the skin. The surface showing in the cycle smoke deposit was less than one lock in diameter. Was it suicide or marker? It is known that in a case of suicide it is possible for a weapon to be found several feet from the hand of a victim who has fallen on the The forefinger or trigger finger of the right was examined with the microscope and the naked eye, and the mystery was solved

and the mystery was solved.

There was a deposit upon the right side of the fore-finger extending about three-fourths of an inch back ward and forward from the middle knucke, made there at the instant the trigger was pulled. The thin open-ing between the rear of the revolver cylinder is rultted the smoke from the discharged carridge to escupe and the smore from the discusinged cartriage to escape has deposit on the finger. A section of skin was removed from the finger and filed with the coroner, and as this was certain evidence of suicide, it outweighed all state-ments of the neighbors as to the so-called consciousness.

of guilt which to their minds were suspicious actions.

From these cases we turn to the far West to make rison between primitive methods which were

4.3

employed in a man hunt and the scientific methods introduced to es tublish the mill of the bunted man Our attention is directed to the sun baked elevated plains of Arizona, baked elevated plains of Arizona, near the Maxican border, where there dwelt, in an adobe but an old man of considerable wealth who had the very bad habit of keeping his money in tin cans about the premises. Ultimately he was found robbed and murdered, his head erushed in by a blow, and in the bargain his throat cut with his own

An Indian was enlisted to trail the murderer, and followed him for The first point of interest the pursuit was a but is force

which a fire had been built, as marked by smouldering ashes. Inside a piece of a man's undershirt was found buried, with two blood spots on it, at opposite sld apparently over the wearer's hips. Raking over the ash pile disclosed a few pants buttons, shift buttons, and even fragments of the shift. The trail then led past a blood marked boulder, and finally into a half breed village and to the but of a Mexican of good repute Here there was found a stranger, whom the woman of the house had taken in that morning and given food She declared in her broken English that she did not came from He was arrested as the murder suspect and the sheriff walked him about for a short time to

ade by the man were declared to be identical with some that had been followed for so many miles.

A causal inspection disclosed no injuries on the man's

body, and his clothing was clean and without evidence they, and his continua was come and without evidence of blood stains except on the thick edge of the sole of the right shoe, where there was a dark red deposit about a quarter of an inch in diameter. It appared to the sheriff to be a blood stain, and when the Mexican the snerint to be a boosd stain, and when the Mexican was asked to explain its presence replied that he had been riding a burro and he must have pricked the animal with the stirrups, accounting for the blood on the inside of the show which would have been next to the animal. There was some plausibility to the story, but it was now possible to abandon the crude methods of the Indian scout, and bring modern science to bear upon the problem. A small portion of leather contain ing the blood stain was cut carefully from the shoe and was taken from Arizona to Juburn > 1 where it was submitted to an examination by Hamilton who made a chemical and microscopical analysis and reported that the stain on the shoe had been made

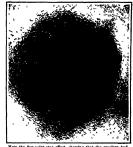
At this point it will be necessary to digress from the thread of the story long enough to say that there is a simple chemical test for determining if a stain upon any object is blood, but to determine whether or not the onger is moss, our to determine whether or not the blood is from a human is ing or from un animal is a more difficult problem. Blood is composed of this coloriest liquid piasma illed with red disks or exist with one white globular cell to every three or four hundred red ones. The blood is no more red than the water of a stream would be if it were filled with little water of a stream would be if it were filled with little red fishes. Suppose the fishes to be very small as small as a grain of sand, and crowded clost together through the whole depth of the stream. Under such circum stances the water would look quite

red and this is the way in which blood boks red

The red disks or cells are so small that 1500 placed side by side would measure only an inch and it would taken sixteen thousand haid flat wise upon one another to make a column of that height Under the interscope the cells or corpuscles are found to be rounded at the odge and concave on both sides and have a tendency to collect in piles like rolls of colns. They are continually forming in the blood and as con-stantly dying. The size and shape vary in different animals and those of animals vary from cells of human beings, and by means of a micro sconlent examination it is possible

to distinguish human blood from that of animals

After the blood examination, Hamilton said that if Arrest the onoise examination, mainten said that if he could go to Arizona where all of the exhibits were kept, he could, by means of his methods of examination, determine if the accused man were gullty. In the meantime, the Mexican had been indicated for murder and was awaiting trial and Hamilton went to Arizona, as he desired to do and made some important discov The shoe from which the blood stain had been removed was examined with a high power microscope when it was found that a small row of holes



Note the five-point-star effect, showing that the ravolver had five lands and five growes, and leading to expert identifi-cation of the make

Smoke deposit from a 32-caliber revolver, black powder, muzzle one inch from the skin

The portion of the undershirt which was buried was next examined, and it was found that the blood had congulated on the inner surface showing that if had not come from the outside and seaked through. It was therefore exident that the blood came from the who were the shirt. It was also exident from the loca tion of the stains that the blood had either come from the thighs or from the crotch where it might have stained the back and the front of the shirt Next the body of the defendant was stripped to the

kness and extinined thoroughly. Upon the upper and discovered two fresh appearing pink colored scars about an eighth of an inch wide, and parallel to each other The upper sour was one luch in length and the lower one one and three-eighths inches long both being nearly parallel with the ground as the man stood creef had the appearance of completely healed knife wounds caused by a knife thrust where the knife had entered the lower wound and come out of the upper wound. It was evident that the two wounds had been made by a single builte throat. The large broad knife found near the murdered man was examined next, and it was found that the entire blade had been more or less smeared with blood from a human being

with blood from a human being it was found that the taper of the kulfe blade was such that points on it could be found at one of which its blade was an 'nch and at the other an inch and three-eighths wick, and the distance between which was be some as that between the scars. That settled it in all probability the bread knife had been held in the right hand of the murdered non as he lay back on bed and he had struck upward at the body of the murderer and the black had entered the left leg such a position the kulfe thrust would have passed through the overalls and under the shirt of the mur

that olsarved

At the murderers trial the findings of Hamilton were given to the jury The defendant on the stand claimed that the scars were made by being gorsel by a victous goat when he was a boy but every juror, all ranchmen, knew that the narrow scars were made by some instrument similar to a bread knife. The conviction was secured on the showing of the brend knife and the scars. It was never known how much gold the Mexican secured as several thousand deliars in gold coins were found buried in cans beneath an arbor adjoining the victim's but The murderer was sen-tenced to life imprison-



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Rear view of the Elmira murder

revolver cylinder, showing the order in which the cartridges were fired

st, magnified 25 diameters, with actual dimensions marked of the grooves and lands. It was claimed that the builet was fired dimensions are shown at the right. Creater Microscope instrumeter such used in making delicate measurements. Right: Creat-A, thorizon, by divergence from the marks on the builet. that the latter could not have been fired from this weapon The role of the microscope in establishing guilt and innocence

Behind the Underwriters' Label

The Gruelling Tests Imposed by the Insurance Man Upon Materials and Appliances By A. G. Ingalls

IEN we read that a manufactured product has been "approved by the Underwriters, what is the reaction that takes place in our mind? Obviously, the phrase has a our minor rotionay, the pursue mas a favorable significance else the inmunfacturers would not include it in the description of his product. If we are the average human being, busy with troubles of our own, the chances are that

somewhere in a remote correct or one, the chances are tonk
somewhere in a remote corrier of our mind we may have
a hasy idea that the phrase indicates that the object
la freproof Maybe the unamfacturer, when he got
around to it, sent a sample of his product to the Under
writers, and the latter, turning it over in their hands writers, and the latter, turning it over in their hands a moment and sating it up said it looked as if it wouldn't harm very could you have write back that are their hands and approval if they wanted to But it has it done that was. The way it is done, which is the glat of this story, is the best sort of proof that to have earned the right to lear the words. Valleyer viter Inhoractories—in

to lear the words, "Underwriters Laboratories—in specied," a product must have passed through an inquisition, figuratively and literally of fire and water When the Theirwriters have finished teeting an appliance, or a new kind of rooting, or of flooring, or and have supervoed it—if they have approved the control of the provided the control of the co it—it is a safe bet that it not only involves a low fire risk, but is from every ordinary angle a good and de-pendable piece of merchandise

peculative piece of mera handles. How they do, on at the job Is ably and interestingly told in a work estition, "A Symbol of Safety," by Harrison told in a work estition," A Symbol of Safety, by Harrison told in a work of the prediction as more presenting the out of an idea in the mind of one man thirty-peers ago. If was in 1886, they have of the Worlds hair at Chempa, and the electrical irradiation at the present the safety of the safety of the safety of the safety of the country of the min because they was little established. count of this and because there was little established data of the requisite quality of electrical equipmer the fire insurance companies were worried about the possibility of a great fire starting at the exposition from inadequately insulated wires. At that time a young man named W H Merrill made the suggestion that an electrical testing laboratory be set up. So well that in electrical testing laboratory he set up to we did he "self his idea that he was given a small room and was included in the modest luxury of a helper a clerk and \$k50 worth of equipment for the job.

When the Chicago exposition job was done, Mr

when the Criscio exposition 100 and done, air herrill was told to accept on doing it same work for the Underwriters. He is doing it yet. Today he is president of the Underwriters' Laboratories, Inc. of Chicago, but instead of the two helpers of thirty years

ago the work keeps 150 busy. And it is still growing.
When it comes to telling just what sort of things When it comes to filling just what sort of things be Unders ritery Laboratories pass judgment on, it is hard to include them under any single beauling—unless hard to include them under any single beauling—unless half as Inaccurate as would be an effort to name them all within the space of this page. The Under-witters interest persists to verything this enters into the construction of any building hast is to carry for insurince, and then extends to derices designed ile heedlight for its anti-glare properti-totor-driven oil hurner to determine who fool-proof to remove the probability tampered with by the user

Three widely different tests whose successful pas-sage means lower insurance rates to the user of the equipment in question

to reduce insurance premiums of any sort whatever.

The Underwriters want to know, and they make exhaustive tests in order to find out just how many haustive tests in order to find out just how many inneventhera see in a thousand of a structure taking the see in a thousand of a structure taking the second of the secon that no matter how foulprior an appliance is, no matter what instructions for its proper use come with it, some-one will unmare to do the wrong thing and quite likely and the state of the state new is too remote to at the Universitiest Labora-nees is too remote to at the Universitiest Labora-nees in the state of the state of the state of the trives the electric curling it on is tried and tested and lottered it is "sampseed with in every way, but always having regard to out thin—low might it start.



a firs? This is only one example of the many tests. Necessarily, since all kinds of things are to be bested. Necessarily, since all kinds of things are to be the second of the second o

Manifestly it is impossible to test every item of every anufactured product in the Chicago laboratories. Last manufacture produce in its chingo score store. Last year six hundred million labels were pasted on approved products. The result is that much of the work must be conducted outside Wherever in the nation things are made the Underwriters' men must go, For, if only a sample of a given product is tested, what assurance is there that the output will be kept up to sample? To get around these difficulties the Under-writers divide their work into three phases. There is the re-examination service, involving such products as sampley '10 per drough these uncertain the december of the control of the control

This given a test of the five-resisting qualifies with re-part to brands flying from adjaces buildings. The third and severest test is the wind driven fiame test, which forms the subject of our current cover design. A roarring mass of oil-flame drives by a 12-salis strifficial wind attacks the surface of the roofing until it is ig-nited. The time required for ignition and the rate of spread over the roofing are abodd.

Automobile Race Track on Factory

PIOS EXCENTIA the testing of its auto-mobiles under actual road conditions and at varying speeds, a well-known Ital-ian automobile company has constructed on its Actuary roof what is no doubt the first race track of its kind. As the auto-mobile chassis leave the assembly short, they are placed on an elevator and carried to the road of the factury in which they to the root of the ractory in which they have been built, where, more than 100 feet above the level of the ground, there is a test track To feet wide and nearly three-quarters mile around, on which the chassis can be run under the direct con trol of the staff engineers. The track, formed of two straight stretches united by banked curves 20 feet high, permits of operating the cars at the highest pos-

odd automobile testing truck occuand one automorale teams, truck occa-ples the greater part of the roof of an immense rectan-gular factory building at Linguito, a suburb of Turin The works conduct of two main parallel blocks, united at their ends and measuring 1270 yards around. The at their ends and measuring 1270 yazin anuml. The space between the two main blocks of buildings is divided into four large courts by litree transverse the five four to the factor, by means of four electric elevations in each transverse building. In all, there are seventere electric elevation is this large plant. The root test track is omateracted of reinforced con-crete with a special kind of aspekt has to opt dressing. A crete with a special kind of aspekt has to opt dressing.

thick concrete wall five feet high, on each side of the two straightaway sections and on the inside of the curves, as well as a on the Inside of the curves, as well as a well are well nearly ten foot high on the outside of the curves, ensures eachly for diverse. Advantage is taken of the extreme banking to install workshops in the wallable squee below the truck These wallables are used by the test drivers the curves of the curves are the curves of the curves of

The straightsway stretches of the track are slightly cambered in order to allow water to run off into the guiters on the sides. As the hot water heating pipes are carried on the calling of the shops immediately under the track, there is suf-ficient heat to melt snow as it falls, so that the race track is available through

out the year Chasels to be tested are brought up by electric elevators in the transverse buildings. After receiving their quots of gasoradiator, the engines are started and each

chands nots out on the track for a pre-liminary run of ten or twelve laps. On returning, each driver reports in writing to his chief, who exam the chassis and then turns it over to other drivers

nees the classes and then turns inverted one curvers for further tests, each driver reporting in turn. If any defects appear, the chassis is returned to the factor? Chassis which pass the tests satisfactorily are sent down to the body department or for delivery, as the case may be. After the bodies have been fitted, further tests have to be carried out on the track in order to ascertain once more that all the mechanical parts function correctly, and that the elec-

satisfactorily
From morning until night the roof track
represents a seeme of bustling but wellFrom morning until night the roof track
represents a seeme of bustling but wellcapacity the seeme of the seeme of the seeme of the
rained, a chassis is pushed out, and a few
rained, a chassis is pushed out, and a few
rained, a chassis is pushed out, and a few
rained to the load to the seeme of the
fanghed limouslases untiling round and
formed the speedway Heavy truths keep
low down on the banked curves, which
seeme of the seeme of the top. satisfactorily

tric lighting and starting system operates

Express Company Equipment
THAMSPORTATION with an express
t company must be reduced to a science.
No suntimental selection of, equipment or a company must be reduced to a science. We santimental selection of equipment or gross-work method of operation or slip-shod method of maintenance can be tol-cetted. Edward B. La Schum of the American Relivery Express Company gives some chipsenting finds regarding equip-ments used by our lergest express company



General view of the factory-roof race track and one of the four courts in the nt Workshops for making adjustments, placed under highly banked curves, are reached by inner track

During the just year more than 184,000,000 shipments were handled and these shipments had to be handled at least once at point of origin and at least once at point of destination, in addition to landlings on route The average weight per shipment was approximately 82 pounds, producing a gross revenue of approximately \$294,000 000. From the magnitude of the business it can readily be seen that it is peressure to make a most ction of vehicle equipment

in New York (1); the company requires 655 motor vehicles and approximately 600 horse-drawn. In Chi-cago they use in daily service about 648 horse-drawn



Another view of factory-roof race track, showing a banked curve 20 feet high. High speeds can be developed in safety on this track

vehicles and 306 power vehicles, including 25 tractors with about 60 traillers. The total vehicle equipment throughout the United Natics and Canada consists of 2000 possiline vehicles 1185 elsevice street rucks 234 electric industrial platform tracks and 100 semi-trailabout 8500 horse-drawn vehicles, which means a total of 12,755 units of which approximately 33½ per cent in numbers are motor vehicles with 50 per cent of the total especity. Matistics show that in express service the horse-drawn vehicle averages approximately



Eight-wheel motor track with one of its right rear wheels on a 10½-inch block. The trunion was raised only 4½ inches, due to the unique spring construction

12 miles per day,, the electric ve miles per day and the gasoline vehicle 30 miles per day, which surely is sufficient advantage to justify their pred

The Acid Test for the Eight-Wheel Truck

COME interesting and unusual tests were in recently made with the eight wheel motor truck recently perfected by Mr. B. B. kageol of San Francisco. One of the right rear whoels was run upon a block 101/2 inches high Measurements were en made which showed that the trunion was only raised 4% inches. In another test one of the rear wheels was run upon a block 12% inches high During this test the trunion was only rulsed 4% inches or only three-jighths more than with the 10½ Inch block

All of which is due to the unique spring construction. There are two sets of springs on each side which are connected. The trunton is free to rotate in a hearing which be carried between the upper and lower springs on each side, and it was be-cause of the flexibility of the axis construction that the trunion was raised only 41/2 inches when one of the four rear wheels was on the top of the 12% inch block

In another test the truck was run over railroad tracks out causing any jar or joiting of the passengers, This truck recently carried seven tons of cust from from Nan Jose to Nan Francisco, a distance of 51% miles, in two hours and fifteen minutes. Two man rode in the cab and they stated that the truck rode as easy

touring car Phis truck can carry nine tons and tow This truck can carry nine tons and tow a trailer or trailers carrying 11 tons, or a total of 20 tons, at a sustained speed of 35 miles an hour—11 made six miles on a gallon of gosoline while carrying

Exports who have seen this clight whool truck in operation claim that it has meny advantages over the four wheel truck for ripld transportation of large loads of per islable goods, such as fresh milk and rips fruit. The extremely flexible axie hang ing of both front and rear sats of wheels eliminates three-quarters of the road she Tis milk is not churned nor the fruit

bruised The small where with low spring su pension bring the weight close to the ground yet allow ample road clearance. Hocker action of trunions keeps the wheels down in contact with the road thus pro slding sure steering and constant traction Skidding, or overturning is impossible in any ordinary operation of this truck Eight wheels and small three ensure post

tive steering of this car in spite of blow-outs or even the loss of a wheel. Bydaulic brakes on all eight wheels provide case and sure control of a heavy load speeds up to the legal limit can be maintained with safety and when emergency demands that the limit be disregarded the brakes and steering are such as to any speed of which the vehicle is cupuble

The front and rour wheels are all alike, and the small ordinary stock tires are inexpensive. The weight is evenly distributed and the load balanced so that the

front wheels carry their proportionate trated on the rear axle. It follows ther fore that moderate the pressures are sufficient bilintination of slippage and skidding save wear on driving tires. Internal steering phots permit the front wheels to run straight, thus avoiding wear wheels to run straight, thus avoiding wear of three due to customar, "tooling in Brake linings are durable on account of large brake area and even application buck is not wasted in bouncing and racing of the driving wheels over irregulari ties of the road

Freedom from twist and far secure long life of frame and body of the truck Min mized weight per wheel guins approval of highway supervisors Pavements are saved ingnwy supercisors into ments are saved from concentrated impact and tires from overloading, by eight points of contact with the road. Free steering easy brak-ing and comfortable riding leave the driver untroubled to watch the vigilance, according to the claims made by the design



Rebuilding a worn axle

A 46-inch slab shear, welded for \$833. New plate would cost \$4500

Repairing locemotive frame in place

Electric Welder Vs. Riveter

The Past Successes and Future Promises of Electric Welding

A

MONG the many valuable services rendered by electricity must be reckoned the art of electric welding, which already holds an established position and promises, as it breaks down old, established prejudices to monopolize certain constructive and re-

pair work for which it is possibility will fitted. Although the recognition of the value of clerric welding is of comparatively revent date, it was successfully done by killin Thompson nearly half a century ago, and down through the years it was used in a more or less tenta the way until the Buldwin Locomotte.

tive way until the Buldwin Lessmottes. Works and the Felt Bullives is gent to the property of the property of the Peri Bullives is gent to the property of the Peri Bullives in the paper of the property of the Peri Bullives and the rail and property of the property of the property of the property of the Peri Bullives in the property of the Peri Bullives in the property of the Peri Bullives in particular. In the property of the Peri Bullives in particular, and the property of the Peri Bullives in particular, and the property of the Peri Bullives in th

The very graffying success which are welding has achieved in hoomotive building and repair work now bids fair to be duplicated in marine work. Here its efficiency was most demantically demonstrated when

efficiency was most dramatically denometrated when the United States Government select the German ships which were lying in our ports and determined to turn them into transports for carrying the United States troops to the theater of war in Lurone Although this is an old story it is so perfinent that the outstanding facts may well be recapitated.

When our entry into the war became evident to the German Government, they sent instructions to the officers of the German ships in our ports to so theroughly disable the engines that it would be impossible

for us to make use of them for a period of from chilteen muthe to two pars. In curving out these orders, the German segment of the control of

make new cylinders, vaive chests, etc. so laddy were these parts broken on the damaged ships While the subject was under discussion, a few of the

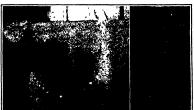
While the subjet was under discussion, a few of the ships were transferred to the Navy and sont to the Nav Auck Navy Yard for require. Here Captain E P Jessop, after conferring with an electric wedding compant, recommanded that the bracker cylinders he reported to the conferred with the control of the conpant of the control o

BUTT WELDED THE SAME PLATES AFTER MELDING

BUTT WELDED A WELDED PIPE

Comparison of riveted and welded joints

electric wilding, and to resert to mechanical matching, and to reserve the mechanical matching to the mechanical matching to the mechanical matching to the mechanical matching to the relationst the character of the breaks in the vilinders set, and igne tear evidence of the arious nature of the highries. So but were they and an autocutation of the highries within in German data matching of the mechanical matching the mechanical matching the method of the method



Left How the Germans drilled and then knocked out section of cylinder Right Similar damage in a cylinder liner. Both welded and giving good service

our trougs to Kurope and bringing them back again.

In a report not me matter, the engineers in charge
of this purit, ular work say that on the cylinders of
the twenty vessels of German origin, not counting for
the twenty vessels of German origin, not counting for
no less than 118 major breaks. Had not are weeding
been available, the rapiers would have cetalised the
renewal of some seventy cylinders. It should be noted,
the inguist of the large scale of the dumage, the work
that in sgitt of the large scale of the dumage, the work
in any instance removed. After careful estimate to
the Navy Department it, was established.

that the use of arc welding had resulted in the saving of twelve months' time and

of #20,000,000 in money. We have referred aiready to the necessity for heat control where the electric are in used. The system used on these ships, and most successfully used elsements of the system and the successfully used elsements of the system and potentials, too voltage system, which operates on a general voltage of thirty-free. With this voltage it is possible to deliver and maintain a critical degree of the state of the system of the syst

electrons and the metal to be welded. The great heat funes both the work and the electrode, and the metal from the lutter is deposited on the metal. In preparing the situating edies for welding they are so shaped at the bottom, is gradually filled up as uncensive layers on metal are deposited from the electrode. Referring to the work done in repairing the cast-true quincies on the German single, Capital reason states that invessibility which the cast of the state of the weldshift when of hard cast iron at the line of the weldbott through with fagers of gar quest iron, while be-

slight velo of hard cast iron at the line of the weed, shot through with fingers of growy cost iron, while behind this area there is within no heat in repairing the German ships was easily workshibe with hammer, chiese, files or cutting tool. Another very important fea ture is that, with the use of low voltage ture is tool. Another very important fea ture is tool. Another very important features in the ture is tool. It is the use of low voltage that is the ture is a unfaint on feat framework. It is being it into the heat for the heat forcementy to bring the electrode and the face of the motal to be welded that a semi-plastic statis, thus

be welded into a semi-plastic gata, thus insuring a perfect physical usion.

Are welding is being successfully applied not only in being successfully applied not only in being construction, but in the building of large tenks for the upper control of the perfect of the perfect

A Rudder that Turns Itself

By Dr. Ernst Fourster

A CONSIDERABLE sensution was caused in European shipping circles when the new Fietmer rudder was first adapted to the small sen-going cargo steamer "Frigide" of the Butavier Line. The idea of this rudder "Frigide" of the Batavier Line. The idea of this radder is to do away with power steering by steering conjunction in the conjunction of the conjunction of the conjunction of the conjunction of the small radder working at a long lever, and effects of the small radder working at a long lever, and effects of the small radder working at a long lever, and the conjunction of the small radder to controlled by means and conjunction of the conjunction of of a mechanical gear, composed of a pair of yokes and horisontal rods, transmitted vertically through the hol low axis to the head of the main rudder nest. In the case of the "Frigido" there is a drum connected with the top of this gear upon the rudder head, whence a the top of this gent upon the rudow head, whence a steel rope axiumeter gent passes to the wheel on the bridge. After this 200-ton vessed performed satisfac-tory service for 2½ years it was decided to apply it a larger vessed, the "Odenwald," of 5000 tons register. The operation of the rudder will be mude clear by a

study of the accompanying line drawing, which shows the essential features of the dovice A vertical shaft, operated by the steering

wheel at P, is geared to a horizontal shaft, K This, in turn, to a vertical shaft F", which by means of bevel wheels at its lower end serves to operate a length of bortsontal shaft, which terminates above the rudder post, F, of the main rudder The rudder post, F, is hol low, as is also the main rud der, A The horizontal length of shaft above mention geared, by means of bevel wheels, with a vertical length of shuft which passes down inside the main rudde where it curries at its lower end a yoke, O, which, by means of a pair of horizontal rods, is attached to another yoke at the head of the small nilot rudder, or deflector B, located at the after end of the main rudder. It will be seen that by operating the steering wheel, P, the pilot rudder, B, may be caused to turn to nort or sturbuard, at the will of the steer When the pilot rudder is turned to part, let us say, the rush of water results in a pressure to starboard,

which, acting on the long lever arm represented by the distance from the pilot rudder to the axis of the main rudder, exerts a power-ful pull to starboard and throws the main rudder to Similarly, if the steersman turns the plict rudder to starboard, its action will pull the main r over to port. Furthermore, the turning moment will be proportional to the amount of deflection given to the plot radder, and the main rudder will assume the design of the proportional to the main rudder will assume the design of the plot.

sider radder, and the main rudder will assume the de-sided angle of belin.

The "Odenwild" rudder, which was built by the Detuchen Werft with all the necessary gard, has about 140 guarate feet of surface, and the second about 140 guarate feet of surface, and the second of the condition of the surface of the defector is and bollow. The turning gear of the defector is in dependent of the motion of the nain rudder, the latter being sible to move freely in a complete circle like a weather cock. This always happens, when the slap is to go astern. The latter is the rudder through 130 forcess, and it then note as a bow rudder. The steepropeters automatically turns the rander into all degrees, and it then acts as a low rudder. The steering principle then remains the same, the pilot and the mag principle their remains the same, the plact and the main radder acting every promptly under the influence of the propeller saction. The main rudder reverses theelt under the influence of the astern turning pri-pollars before the ship herself has begun to go astern The deflector gear leading from the rudder head to the wheal on the navigating bridge, in the case of "Oden wald," is a rigid one, with one-inch round steel rods carried in bearings on deck and provided with suitable gear wheels. This gear has worked satisfactorily on a 30-hours' trial, when the vessel was steered by the

hands of a wheelman, and the ship was placed in regular service without any material alterations, the only change being the substitution of ball bearings to reduce friction

The Hamburg American Line, as owners of the Odenwald," have combined this invention, on board "Outswand, nave commune unis invention, on noaru this ship, with another one of no less importance, called the "Anselulis-Kreiselkompass-Selbsateurer" Dr Ans, date' well known invention of the groscope compass has been developed by the same inventor to take the place of the wheelman. Take result has been obtained by the following method: At the circ uniference of the work of the circumference of the circu of the compass are electric contact points, opposite to which a single contact point is fixed to the body of the which a single contact point is fixed to the fooly of the grossope. In the lower part of the compassions, an electric motor of about one-half hors, power is provided, which is connected by a Gall chain to the axis of the steering wheel. The motor is controlled by the abovementioned system of contacts, depending on the turning motion of the ship. The officer of the watch fixes the motion of the ship. The officer of the watch fixes the course which the ship is to follow—the rest is automatically done and continually corrected by the general sequence of the continual corrected by the general source exact than that by an actual wheelman, and it has the advantage that it never gets tired. One marked advantage of this automatic steering is

that the course is straighter than that achieved by hand steering, with which a more-or-less ways wake results.

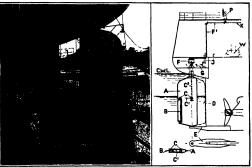
us late as 1896. He says, in summerizing a disci on the causes of curriquakes. Although it would be an easy matter to discuss the relationships of earth-quakes and other phenomena, we must conclude that the relation cause of the primary cause of earthquakes is endogenous to our earth, and that exogenous phenomena, like the attractions of the sun and moon and barometric fluctuations, play but a small part in the actual production of thes na, their greatest effect being to cause a slight paesoners, their greatest erret neing to cause a sugar per ponderance in the number of enrichquakes at par-ticular season. Tary may, therefore, sometimes be regarded as fand causes. The napority of earthquakes are due to explosive efforts at volcanic foct. The greater number of these explosions take place beneath the sea, and are probably due to the admission of water through and are promoted twick the animation of water through flastics to the heated rocks beneath A smaller number of earthquakes originate at actual volcanoes. Some earthquakes are produced by the sudden fracture of rocks strata or the production of faults."

risks, strata or the production of faults."

This volunit theory is now generally abundanced as
the chief or even us a very important cause of earth-quakes thought its, of course, admitted in special cause.

Larrhiquiskes are now almost universally recognized
as being of tectonic origin. "This change in opinion has been brought about chiefly through the labors of I ontessus de Ballore and the lated Edward Suess. Both thes authorities have demonstrated the intimate rela-

tions between lines of crustal weakness and the distri-bution of cartiquake foci M. de Montessus de Ballore has attacked the problem on a grand scale, taking the world for his province. Spess has particularized and demon strated the relation for such districts as the Murz Line, Calabria and other centers. The most striking densenstrations of the truth of the tes tonic theory were afforded by the surface displacements along fault lines during the Mine Owari the Assum and the California carthquakes. A great many other work-ers among whom, perhaps, Omori and Davison are pre eminent, have long since investigated the relation of curthounke centers to fault gin of earthquakes may now is regarded as being firmly established — Abstract from article by I & Cotton in the Bulletin of the Belamological bociety, Nos 2 and 3,



This rudder is operated by the small pilot rudder B which is prooted at the after edge of the main rudder A. Pilot rudder is operated by steering wheel P, through shafting F, F, C and yokes and link C C

Earthquakes

THOM the very endlost times the attention of man FROM the very ordinet times the attention of man-lusa here arrowed by sattingues phenomena. This has been arrowed by sattingues phenomena. This been perturbed by disastrons sho be. The Chinces and Japanese revocals contain frequent references to the destructive effects of the larger shocks. The impo-tance of the containt of the containt of the con-taint of the containt of the Jews. The great cartinguise which occurred in the reign of Usriah was used as a default point to which subsequent events were g after referred

Such events could not come and go without arousing curiosity and speculation as to their origin. In un civilized or semi barbarous communities these specula tions either attributed the cause of carthquakes to the movements of some subterranean monster or to supernatural agencies. Among more cull, hiened peoples a more rational attitude of mind prevailed. For example, Aristotle, Pliny and others held the view that the movements were due to imprisoned wind or vapors seeking to escape from beneath the earth—a view after all not far removed from the more modern theory of

volcunic origin for earthquakes.

As the borizm of man became wider through so graphical discovery the intimate relation between the distribution of volcanoes and carthquakes become ap-parent, and it was natural that earthquake phenomena parent, and it was natural that cartinguake phenomena should be attributed to volentic energy. This has been the dominant view of the last century, and prevalled until its last decade. This may be seen from the view expressed by Milne, the father of modern setsmology,

Proof of Einstein's Theory from the Atom THE light from the in-

a terior of the atom, as will as the light from the distant stars, gives evidence in support of the Einstein theory of relativity according to Professor A Sommerfeld of Munich

1 of 12

According to the modern view of the internal stru According to the month view of the internal nucleus of positive tire of the atom there is a central nucleus of positive cleetricity around which revolve at high speed one or more negative electrons. These may move in circular or in ciliptical orbits as do the planets around the sun or in enigical orbits in do in planets around the sur-if the orbit is a circle the revolving electron moves at an even speed throughout its course. But if the orbit is an ellipse the electron must move faster when it is unking the turn nearest to the central nucleus at the focus than when it is at the more distant end of the focus than when it is at the more distinct end of the cilipse. This difference in speed would make no dif-ference to the mass of the electron according to the old Newton theory, for this assumed that mass was unattenable. But according to the new Educated theory, a particle moving at high speed is I avier than when moving slower, so that electron would vary in mass in different parts of its elliptical orbit and therefore the energy it have off in the form of light would depend upon the shape as well as the major diameter of the

There are only a limited number of such orbits that There are only a limited momor of such orbits that an electron can pursue, and in aliquing from one of these to another a certain quantum of light is given off which may be recognized by its position in the spectrum. The light given off from the incundescent gases, hydrogen and helium, as well as the X ray spectrum of I metals like platinum show that the corpuscles making up the atom obc. Finstein's law instead of Newton's Thus Linstein scores still another point

Psychic Adventures on the Continent

Sittings with an Apport Medium in Berlin, and Interviews with Several Notables

By J. Malcolm Bird

Associate Editor, SCIENTIFIC AMERICAN, and Socretary to the SCIENTIFIC AMERICAN Psychic Investigation Committee

NOTE were blocking out independently, a prochit tour of Europe, one would probable tour of Europe, one would probable to the probable to the touch that the England My expeditum, however that in the England My expeditum, however and only secondarily with trens of psychic interest in France, Germany, or Newerheless, it was

interest in France, Germany, even Nevertheless, it was on unterel to give as much time as possible to a white though the Continent, and I finally got away from London on the evening of March 18, immediately affect was silling with Hope described in our lime basic Beword the knowledge that Paris was up first joint of all my schedule was left to from Hedf and went along

In Faria I had very interesting conversations with Dr Godey research officer in charga at the Institut Wetapevchique Incountry of the Committee of the Committee of Pavchia Rosserch* will be reviewed in these columns at on earth date. I need since I arranged with the Goden for sevesine I arranged with the Goden for seveeral signed artists, in which is will tell of his work and of the general state of peckin research in Parine better than I seeker teaming them as I was able to conduct. I saw Dr Godey in Bostoners and dut. I saw Dr Godey in Bostoners and

his unswan and was continued, luquessed to he partially gives obtained allipselly, as cests of the hards of uniterialized spirits in the presence of the Poblic medium Klussid. These cursts have not been adequately downless in America and were it not that I have out the six in the continue of the continue of the continue and the continue of the continue of the continue of the breatte artists on them, accompanied by photographs, I should give to large over thus here.

Income and arts, besting, London. I and been in comunitation with Dr. Affred Gradewitz of the very valued birth correspondent of the SULPTIA AMERICA I and less maximum for this to us to Munich and not innaise the psychia entire of Germany. Hinces in his finally made this impossible however and at his unject recommendation I went to Berlin first, as all unjects recommendation I went to Berlin first, as all control of the succession of the succession of the control to the succession of the succession of the succession of the succession of the total lateries."

Dr Gradenwitz had arranged for me first to see the Grunewald pytchic laboratory which he had already described in our issue of July, 1922. I found the ap-

Prau Vellhard caught in the act of producing

paratus extraordinarily interesting, and Herr Grunewald no less so. Then mrangements were made for a scance at the apartment of Frau Vollhard, and this was held on the evening of March 20 Frau Vollhard is entirely in the hands of Dr F Schwab, a practicing physician who has been examining

held on the evening of March 20
Frus Vollmerd is entirely in the hands of Dr F
Schwah a practicing physician who has hene examining in the rendermental physician who has hene examining the rendermental properties. Dr Schwah had it all settled in his own mind that as the price of the source I was to agree, sight unneed to publish in the STEPTENS AMERICAN on article which he had written about his medium My cutegorial rebusal to do any thing with this article beyond renduct it and making a trecummentation to the home offer thereferred to the discremental properties.

WITH the present article, Mi. Burd concludes his accounts of his informal sitings with European mediums. He has had one more informal sitings with European mediums. He has had one more columns, and the prespects seem good that he will have further seances of this character, in addition to the formal lest sitings held before our Committee. In the meantime, there will shortly appear, under the title "My Psyche Adventures," a book in which he will desprise, much more fully than he has had space to do in these columns, his impressions of and experiences with the mediums when he has net informally.—THE EDITOR.

us to a deadlock, but we finally found a way out

agreed to pay him a seame fee of ten dollars, and to tend the article. If I then found it worthy of transbation and reproduction in our columns, I was so to

nation and reproduction in our comman, I was 30 or recommend, and if it was thus used, the ten dollars was to be deducted from our payment for it. When the artick reuched my hotel the next marring I was agreeably surprised, it was by no means as hopeless as I had foured. The accompanying photographs are from it and a good deal of the accompanying informs.

from it and a good deat of the accompanying information about the medium. I suppose we must forgive the middle class German for gottin, excited in the presence of number who has access to the fountain of dollars lie 8-kwish first became acquainted with Feat Volllard in the fall of 1220. Prior to her work with blin,

such a colossal sum, she would not sit in other than her own clothes and would not sebmit to more than a perfunctory search. With Dr Schwah's introduction of science into the

With Dr. Schwal's introduction of science into the source room there came a surprising shift in the medium's scope. When he first tried to get photo-graphic evidence of telektness, he found extopasm in the developed picture, and pursuing this lead, he got very manag, photographs and visible apparaments of this much Controverted substance. One would be furly certain that the medium was not unfulfently well-read to know anything about evolpsism, or sufficiently eleven to contracted Li Her daughter is always present.

however, and with regard to her neither of these assurances would be valid. If there is fraud, she I would be certain is the spility one.

the guilty one
Not long before the date of my sitting,
Not long before the date of my sitting,
the medium had without apparent reason
abandoned the production of ectoplasm,
and returned to the original line 80 I
was given reasonable assurance that I
was given reasonable assurance that I
underwind have some apports, and made to
underwind that nothing else was likely

The medium sat at the end of a small oblong table. On one side Dr. Gradenwitz and on the other I, sat at the side of the

table around the corners from Prus Voilhard. Not it to me came Dr. Schweb and thou the medium's daughter on Dr. Grudewsitz' side sait two grattemen who were precent for the first time. Que was a filter Imagestor, and the other was apparently also the holder of some official position. There was complete darkness saive when Dr. Schweb flashed his red torch to make an observation of some sour.

when I've reviews makeled net were town to make an There were no preliminaries. We simply sat down and waited, conversing. The medium was greatly relieved to learn that I was not not other steeptic and even more so when she discovered that I could manage to keep up with the conversation. She had apparedly to keep up with the conversation. She had apparedly exchanging impressions in Egglish, of which adods else present would understand a word.

had a mental picture of Pr Gradeswitz and myself, exheming impressions in English, of which nobody else present would understand a word. We had been silting for but a measurement or two when the property of the property of the property of the shuddered and ground, and occasionalty cried out tought The medical man who is present when a female medium acts in this glathon usually notes a good deal (Continued on page 250)

and in the first of the error to be a with mind and the first of the error to be a with which compilationes. At these shiftings reliciated phenomena occurred, with numerous apports. Nothing was seen of evolutions or materialisations of the error of the

to Accepted to Freu Vullard. It Schwab, soon after this admission to bee stifting, a wheat to remedie them in the interests of actions. He set up better centrels and better conditions for observation, brought in apparatus of various sorts, bert is permanent record of all the seasons, interested other scientais and got independent vilnesses, carried out medical and manorinest antisective stresses, carried out medical and manorinest antisective to the second of the second of



Another characteristic view of a mean of

A Waterproof Motor for Lifeboats By H. C. Bywater

WHAT is probably the most reliable marine motor of its type ever made is a six-cylinder model developing 90 horsepower at 800 revolutions per minute. developing 00 horsepower at 800 revolutions per minutes which was recently completed for the Roual Nindal Lifeboat Institution of London No ordinary gas motor manufactured at compatitive prices in reliable enough for the severe conditions of constal lifeboat service, and those built for the above-mentioned Institution have always been of special design throughout. The interest and most powerful example would be experienced to the commercial proposition, the cost being prohibitive for commercial proposition, the cost being prohibitive for any other purpose. In fact expense has not been on sidered every deste making for reliability being empiowed regardless of cost.

od regardless of cost good example of the care taken in the design to ensure absolute freedom from breakdowns is the use of six kers, solid with the shuft which fit into as many six keys, solid with the sharr which it into as main groones for fixing every important wheel and lever to its spindle, loose keys and serews being considered to possess remote possibilities of fallure. The watertightness of the motor with all its mechan

inn means almost to savor of a mania for reliability more especially as it is installed in a massive water Yet this feature is considered desirable and the motor would run if actually under water

standples being fitted to the curburctor air inlets to make this possible. One might well sup-pose that the risk of trouble from water could not be further guarded against, but it is, by the provision of a drain well in the case, in which a centrifugal pump is working If therefore any leakage should occur through damage to the case should occur through thinking to the case (a by no means impossible c ntingency) or, if the hinged flaps at the top should be open and a sea drive in, the water would be at once thrown out

Lven dual ignition was not considered reliable cnough, and separate high and low tendon Lent has been fitted with what is practically dual ignition to each the source of supply being either a dyn the source or supply being crimer a type amon or a butter; which is charged by the dynamo. As insulated cable of a high enough standard could not be ob-tained, so a special quality was made for the Institution, of which the insulation remains effective if seaked in hot water while the high tension arrang ments are such that no moving contacts are subject to high pressure Naturally very careful attention has

been paid to the carburetors and the in

duction matem, which in ordinary marine motors are the most fruitful sources of trouble next to the electric the most truitful sources or trouble next to in weight ignition gent. Two cultivaries are fitted one for each set of three cylinders, so that if one fails the motor will still continue to run. Each has two throttes one of which is controlled by the governor and prevents the speed exceeding a predetermined maximum. The other threttle functions in a way which will be explained.



The six cylinders have a e and stroke of 51/2 and 7 inches respectively common water jacket is in one easting with the crank, case and forms the main part of the motor. The valves and their gear are carried in a detachable valve spindles being worked direct hy the came thus doing away with tappate rockers and push rocks This involves an overheid comshaft with

a vertical timing shaft between it and the crankshaft All the ignition gear is also contains I in the calinder head. A light aluminum cover served down mon a

watertight joint encloses the mechanism

As a failure in the supply of coding water to the viludes Jackets would mean the stopping of the motor the pumping and cooling airrangements have been most In the ordinary motor boat installati n the pump dr



A 43 year old logging locomotive, at work in the Redwood Forests of California

A Veteran Locomotive

V the files of the Bureau of Valuation of the Inter-state (numero Commission is an analysis of the life of over 5 000 locomotives employed on nine western rullroads. It was made by Mr. I. H. Adams. Mechanical rullroads It was made by Mr I railroads It was made by Mr. I. H. Adams Mechanical A duation Assistant on the A blow Topk Lond Sonta Le Built and Trom this tabulath is we learn that the average life of these locamotives was 410 years. This is a tilbate to the high quality of the materials and

work jut into American le metives and no doubt it
will came is a surplise not only to the
seneral jubile but a many of the railroad

officials that selves So much his been said about the Ameri on policy of white-sit wripping of machinery that is far from wern out in order to replace it by in improved and more up to date plant that we have ir m 1. (1 vents mails the average term f usefulness. The lee m tive be cause of the very hard service to which it is just was a pulmer's supposed to be really for the semi heap rather early in its energy the more so because the ripid Increase in size the equally rapid im proves ent in details and the luge annual to demand that annually a corresponding

number of by no means old engines would be religited to the serap beat As a matter of fact the older and less lowerful engines as they become unequal to the task of hauling the bears trains both in passenger and freight service are relegated to fighter service and continue to do good work on the less important branches and on the feeder lines of our

great railroad systems. This is as it should be for if a learning receives the benefit of careful maintenance, and is sent regularly to the shops for a thorough over-haul there is no reusen why its life should not be extended if it were destrible to cover the buif co

We present as a striking last in c of prolonged work ing strike, an illustration of a little Buldwin locomo tive which was the first or to operate in the redwood forests of California. It was completed and sent to San to will be seen it is a four whee I rancisco in 1490 I rancisco in 1990 4 will be seen it be a four wheel in his homologic with spark arrestit ranches atack built to the standard look if 4 feet 8½ lackes. The cylin ders are 12 by 16 inches the driving wheels are 34 inches in diameter and the wight when the engine was equipped with fuel and water te about \$8,000 tons. It equipped with the said water is about 5000 tons. It will be seen that the tink which is of the saddle type, is carried above the biler and the fuel in a box at the rear end of the foot pi it. We are told that the specifi-cation called for fuel that was to be wood of poor

When it reached San I rancisco, the 'Seon dismantled and shipped by a salling achooner to Trini-dud Humboldt Company (alifornia The harbor was an open roadstead and the different parts of the loco-mothe had to be hinded by means of a logging derrick monro and to be indeed in means of a logging derrick. The little engine was a nource of great wood rement to the Islamath Indians who were constantly begging for tides. Hence the little 'Sequoia would not infrequently come puffing through the woods with Indians perched on the front bumper on the top of the cab, or wherever they could hold on.

It is related that when Dr Edward H Williams of It is remited that when the handless in the Baldwin firm was on one of his hudness trips to Russia he took with him a plint of the photograph from which our illustration is made and when it was shown to the Russians, they found it difficult to believe that logs of the hugo size hauled by this little train were obtained.

water from the sea and delivers it to the cylinder

Porty-five-foot motor infeboat recently built for the Royal National Life

Jackets whence it is discharged overhoard. For life-beats which sometimes lump over sandbunks this plan drawn in mol foposited in the Jackets. All lifebast motor installations, therefore are now fitted with feeded citcuits in which the water is pumped round and round, being cooled in nexts of tubes which are in mersend in wells to which the uses has free average.

All the main moving parts in the engine are automaticulty inbrigated some by forced feed others by spinsh or drips none is left to chance The oil is circulated by a gear pump The engine is installed in the lifeboat in a copper lined wood case the upper part of which is of steel plate and has hinged flaps which are screwed down upon rubber joints All the controls and the connections to gages are brought to the outside of the case through watertight fit

outs have been ordered

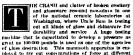
tings This lifeboat motor is very may to control as after it has been started all ma vers are carried out by the The latter primarily controls the reverse gear, but its spindle is connected inside apindle is connected inside the engine case with the throttles above the carbure-tors as already mentioned above.



Smashing Dishes

Why Uncle Sam Breaks 6,000 Samples 2,000 Pieces of China

By George



ployed to try out concentrations of force at diffe points in the glass spectures. By its use accurate data are obtained relative to the aggregate strength of vari-

are obtained relative to the aggregate strength of wir-look kinds of glass for different purposes—information that previously has not been available. All kinds of building, glass, such as window glass, are being surveyed. A curious water pressure system is used to simulate the wind pressure which the western aphyrs often evert against the window panes. experimental satup also permits of securing data of great value to architects who sometimes have to plan great value to architects who sometimes have to plan and design aquariums and other structures made of glass, that are exposed to extremes of water pressure. The novel contrivance consists of a waterlight metal framework which is so devised that a sheet of window glass, that side up and 43 by 46 inches in size, can be inserted between its top and bottom surfaces. There are special rubber guard rulls that fit saugh against the edges of the glass and prevent any water from lenking away

seaving away

After the specimen of ginss is in place, a small space
about one-quarter of an inch in thickness is left directly
above the gines. It terminates in a central glass tube
which widens out into a funnel about 24 inches above the surface of the framework. A rubber hose from an adjoining water faucet provides a water supply which into the tube and fill the glass. The water is allowed to run until its pressure is sufficient to break the sample of glass. A pane of glass three-sixteenths inch thick and 43 by 46 inches in sur face dimension will break to pieces when the water in the tube attains a height of 14 inches. The glass will deflect one-linif in inch is fore it breaks, so the Govern-ment tests have shown. A special recording gage is used to register the amount of deflection in each of the experiments. The action of the water and the pressure it exerts as the glass breaks, say when the water attains a height of 14 inches in the central tube, are the same as though the glass surface was covered with a solid

sheet of water 14 inches high More than 5000 samples of plate and window gla More than OMD samples or plate and window gasses-special strips two inches wide and 16 inches long—have been crashed to pieces on two other devices. These devices are used in measuring the transverse and lateral strengths of the glass specimens. The first outfit is so to Solve Their Secrets

of Plate and Window Glass and More than in Novel Tests

H. Dacy



More than one th ousand valuable plates have

arranged that the sample of glass is laid flat side arranged that the sample of glass is laid flat side uppermost, with the two ends of the glass supported and a suddle attached to a scale but suspended over the unsupported center of the specimen. A shot bucket is uttached to the free end of the scale but and so adsted that when the trigger is tripped, shot from an adjoining shot tower will stream into the bucket. The shot pour into the bucket, in each instance, until the weight on the scale bur is sufficient to break the glass The instant that the glass breaks, the shot bucket falls on a lever and automatically stops the flow of shot. The amount of shot in the container is weighed, and this weight is the index to the transverse strength of the glass sample.

The arrangement of the other apparatus is such that the strip of test glass is laid against a weight flat side up. A metal ball attached to a pendulum arm is drawn back a certain distance and then released and allower to catapult against the glass. The process is repeated until the glass breaks. There is a graduated scale in stalled along the path of the pendulum so that the arc through which it swings can be measured each time the through which it awangs can be measured each time the ball descends. The lateral strength of the glass spect mens is assertained in this way. The ball and pendulum scheme of destruction is also used in testing the dura billity of plates, cups and tumblers. In each case the of glassware or china is held against a he from weight, the pendulum ball is drawn back and then dropped so that it smashes against the article of crock-ery. The test is continued in each case until the dish or glass smashes into smithereens. The cups and glasses are always held against the weight in such a position that their bottoms are exposed to the blows

position that their botterms are exposed to the blows of the avising a ballity of different kinds of glassware and china to withstand require and soutine sterilization of the state of the

chines are used. Study is also being made of the cob-webs of cracks which sometimes develop in chins of inferior manufacture after it has been in use for a little while. The laboratory tests which have been made up to this writing indicate conclusively that made-in-Amerto this writing indicate concessively that made-in-Amer-lea (hina and glassware are superior to the imported dishes and tumblers which heretofore have been pur-chased from French and German manufacturers in rather large quantities.

Dish breakage expenses are always beavy at) hotels in this and other countries. A prominent Chicago hostelry reports that it costs more than \$35,000 annually to replace the dishes that are broken. Other hotels estimate an annual loss of at least 20 per cent of the original cost of their total supplies of china and glassware. The fact that dish breakage is such an important factor in the leak and less items of the average hotel explains the great interest and the cooperative age hotel explains the great interest and the cooperative sasistance of the American Hotel Association which is adding Uncle Sum in every possible way in his inves-tigations. In fact, at present eight of the lending hotels of the United Stutes and Canada are running service tests of French, German and American china. If the actual wear-and tear experiments duplicate the resu actual wear-ind tear experiments unplicate the results of the Federal laboratory tests, the swan song of im-ported china for hotel uses in this country is about to be sung. There is every evidence that the findings of the practical hotelkeepers will coincide with those of the Government scientists, that there is no crockery or glassware in the entire world the equal of that which now made in the United States

Stucco Investigation

Folt several years past, the Bureau of Standards has been studying stucces, and many of its findings have been embedded in a "Recommended Practice for Port land Cement Stucco" which was formally adopted reand Centerl States which was normally acquised re-cently by the American Concrete Institute as one of its standards. The practice covers the application of stuces to all bases, and siltough a massary base is probably capable of giving the most dependable results, it is recognized that there has been and probably will be for many sears to come a larger use of stuces on frame ouses than on massury structures.

The application of stucco to frame houses involves

uncertainties in results than on masonry base and in order to solve some of these problems the Bureau proposes to carry out, in cooperation with some of the introposed to Carry out, in cooperation with some of the interested trade association, a study involving about 30 test punels on the stucco test building. Considerable interest has been shown in this work, and a conference will probably be held in the near future. If the full cooperation of the interests involved is secured it is planned to start work early in the full



Left Large panes of window glass, 43 by 46 inches, are tested on this apparatus in which water p before the glass specimes breaks, is the index of its transverse strength Right? Powerful testing Extragal of the re is used to simulate wind pressure. Confer: The amount of shot, deposited in the basis sing capable of exercing a pressure of 100,000 pounds if incomary, is used in determinists to

A Novel Use for Sugar-Cane Waste

A Novel Use for Sugar-Cane Waste
SINCS the beginning of the sugar industry it has
Siven the custom to use the worste products in a
manner which is far from advantageous. Each year the
sugar world produces an entermous tomages of redduces
cane. Nether is of sug value as a source of sugar
yet the financial success of sugar raising hinges largely
upon their econocidest utilitation in some way.
It has been customary to hurn the baguese, or refuse
cane (asine tomore as mopused), sometimes as foot
tomore the control of the sugar
pused, in the custom
the sugar
pused of disposal it would
have not be supported to the sugar
pure pulse, as the custom
towards of disposal it would
have not be supported to the sugar
pure pulse, as the custom
the supported to the supported

ourn-and that is about all that can be said for it. It has a moisture content of has a moisture content of over 45 per cent, and this must be largely evaporated tion can proceed effectively Moreover, when used as ac-tual fuel, it causes much scale in the boiler tubes and forms many clinkers, in ad

dition to the excessive losses The molusses, on the other hand, can be converted into a rather high grade fuel and the ask from its burning is the finest sort of fertilizer

of heat

possible for application to the sugar fields. If it were burned instead of the bagasse the latter would be able for other uses, with a large hope of the find

ing of these ilian planters are finding at least one use for the riswamin planters are maing at sens one use for the waste filter which is extremely interesting. Obviously some sort of paper can be made of it as of all plant filter. This is done, and the resulting product, "mulch paper," is used in the fields, being ladd in strips over the rows of young cane. As the cane grows, its tips penetrate the paper, and the sugar crop suffers no slow ing up or diminution through the paper's presence. But the weeds that infest the sugar field have not the sharpness or stiffness to penetrate the paper, and they are completely eliminated, so far as the portions of the field

ose to the sugar plants are concerned

A large plantation thus prepared for the growing

ents a striking sight, as our photograph indicates. The fact that the buguese can be thus utilized, with very large benefit to the crop, will doubtless lead to experimentation neces sury to effect a substitution of the molasses for the waste fiber as fuel, thereby com ploting the cycle of two tieth century sugar - plants tion economy

A New Silver Which Does Not Stain

A NEW stain resisting silver has been introduced recently in Great British and, according to a British trade paper, it has alarmed NEW stain resisting s many rotall jewelers. The They for the new metal may ren-der their stocks of silver-ware less salable

The name of the new silver is "Silanca" It is the result of experiments to dis cover a method of making silverware which cannot tar nish in ordinary use The new material is said to be and of sterling silver which is described as an

which is described as an original sade couplex alloy While not absolutely stain less, Silanca restrict term to the remarkable extent and is said to show no fire marks at any stage of making up. The new alloy is pointed to as probably a reside for the homeshod staff from the periodical cleaning of the discussing with the control of the have undergone no other treatment over periods

up to two years. The material is said to be proof ilust atmospheric oxidation and not affected by damp i. There is no need for glass linings in suit cellars de of this material

As supplied to the manufacturing trade, the metal is ductile and can be stamped, spun raised forged or The maintenance of its color and brilliancy over long periods depends upon the proper conditions of working and involves some slight variations from The new material is particularly

retails and

Sugar field with mulch paper strips, showing how the cane pierces the paper, and how completely the weeds fall to do so

recommended for spoons and forks, especially funcy patterns in which, when made of the ordinary silver copper alloy, the presence of fire gives so much When malted under proper conditions Silanca is said to make satisfactory custings sound and free from pin holes, the details of the metal being me exactly reproduced than with ordinary sliver

The inventors have been humps red in their work by the necessity of producing an alloy which is entitled to earry the official built mark denoting standard quality. The minimum proportion of silver to quality for this mark is 921/2 per cent so that all the work has had to be con seep per cut is suited in time work has made to see contracted upon the slight margin of 71/2 per cent of alloging medium. "Slinnen cunnot be used as another in the electroplating bath. The cost at present is about 10 per cent higher than that of slandard silver, but

corrections are to be made its unyielding attitude may be considered a disadvantage. Charts, nups and various photographic productions of the Federal Government are frequently subject to

changes even after they have been engraved corrections heretofore have been made by a cumbersom and time-consuming method involving the scraping of the electrotype and leveling it with a hammer on an anvil designed for the purpose The division of charts of the Coast and Geodetic Survey, United States Depart ment of Commerce se

to devise a more reads way of making corrections on copper Assistance of the Bureau of Standards was enlisted, and the director of this Government agency as-signed W B Bulley a chem to study the problem His efforts coupled with the aid of the engraving and electrotype sections of the Coast and Geodetic Survey have been fruitful of results. Apparatus is now being built for correcting electrotypes in accordance with this dis CONCES

E Lester Tones director of the Const and Geodetic Survey describes this method of correcting en graved plates som what in detail. His statement is as follows

These experiments led to the adoption of an interest ing, and it is believed novel, adaptation of the galvan plastic as thed of electrotyping by means of which it is ossible to remove quickly small or large areas from th surface of the plate to the depth of the engraved work

thus clearing the metal for subsequent reengraving.

An electrode is inserted in the norzic of a hose through which a solution of copper sulfate is thrown through which a solution of copper sulfate is thrown under pressure against the plate on the area where the correction is to be made. An electric Great from a generating source is formed between the plate and the electrode in the nozzle, through the stream of solution impinging on the plate. A current pressure of from 12 to 15 volts has been found satisfactory This voltage is far in a veess of pressure ordinarily used in depositing copper, and the action is very rapid. By making the plate ti

positive electrode, copper is removed from it to any desired depth. The adjoining portions of the plate which it is not desired to correct or after are not affected since they are filled with ink or any nonconducting sub-

By this crusing nethod a depression as deep as the engraved lines is made. By Hv the use of a hammer on the back of the plate the depressed area may be k veled with the surface and, after polishing, the plate is ready for the application of new work which ordinarily will be engraved upon the clean metal by hand

'Although the solution after striking the plate flows over it the only point affeeted is that against which the stream is directed. Small arens of the surface are quickly removed as the en raved lines are not cut

The removal of about me-twents fifth of the thick ness of the plate usually erases all work likely to need correction After this depres

slop is transferred to the back of the plate by bumping up, it may, if desired be filled in on the back by using the same process with the direction of the current

As indicated above, the electrolytic action is rapid An area about two inches square can be removed from a plate to the depth of the engraving in six minutes. This is beyond all comparison faster than any method beretofore used the difficulty always having been in the erusure, rather than in the reengraving



The extraordinary banded appearance of a freshly planted sugar field, with mulch paper strips laid to keep down the weeds

strong hopes are entertained that this figure will be wered as experience in handling the alloy is gain Correcting Engraved Plates by Novel Method

ENGRAVERS and printers—and their number is legion—throughout the United States will be interand region—throughout the United States with the meeted in a new and improved method of correcting engraved plates, or 'cuts," as they are popularly known. The permanency of the impression contained on the electrotype is one of its strong virtues, and yet when

Why Armored Suits Fail

Some Facts Worth Knowing Regarding the Perforating Proclivities of Armor-Piercing Bullets

By Captain Edward C Crossman, U. S. A.



while or even more frequent ly there below up a hopeful

is discovered that certain of alloyed and heat treated steel will afor most bullets Having hobbed up he makes known his purpose which is to try to sell Idea to the police or to the Army or other organization of which the members are likely to serve as targets

Like altogether too many inventors, the armor suit gentlemen are little informed as to the ramifications

of the problem they think they have solved and they do not realize that others have likewise invented armor suits which falled

The Ordnance Department of our Army used to have a special officer detailed just to "shoo away" the in tors of armor suits or armor shields for our soldiers

The little joker attaching to the armor personal pro-tection lay in the fact that like armored ships and big er side stayed ahend very long. Another one was that steel undershirts, while reassuring are somewhat stiff and heavy, not to mention the minor feature that the other side in the war could drill holes in the best one ever made by morely putting a different type of cartridge into a plain infantry ritle The armor piercing infantry ritle bullet wasn't one

jump behind the various light forms of armor developed in fixed trench warfare, not to mention the armored

in most treats warrans, not to mention the armored lanks and other protection in fighting atriplanes. The United States had an armor piercing bullet be-fore the Great War, and I shot it for trial before the-many commenced to defend the Fatherland in northern France

harly it was evident that a sheet of special heattreated steel, one-eighth inch or less, would stop an ordinary jacketed bullet but also, it would not even discourage the armor-plereer. So armor for modern soldiers boiled down to the form used on tanks, to

soldiers holded down to the form used on tanks, the the unsative and markely German trench holmed cover-tions are to the second of the second of the cover-tion of the second of the second of the same as used by all armies. It considers of a miniature, bulled, before the second of the second before than the bullet is which it it is going to be used and harder and tougher than any steel likely to be familiar to the ordinars unan JR will wedge, in the familiar to the ordinary man I 30-caliber, from 60 to 90 grains.

It is set in a regular leaden core and that in turn encased in the regular cupro-nickel jacket of the ordimassed in the regular supro-nickel Jacket of the ordi-nars infantry builet. There is thus a miniature 22-culiber very hard steel bullet, surrounded by thin leadth walls, and thin in turn by the regular bullet Jacket. The leaden walls permit "give" enough to its bullet to wall the bore of the rifle against gas essure,

and to take the rifling and spin the bulkt Outwardly, such bullets look like any other except that they are longer than the standard and seem light for their

On striking armor the jacket smashes to bits the lead disappears in a fine apra) perhaps acting as a lubricant for the steel built within, and the steel core slips through an unbeliev

With the Clay bullet, in ferior to the present Army not armor -- plate at the



An inch of mild steel, with an armor-piercing core of the old-style, light-weight type, protrading.

Modern armor-piercing cores could readily gip through

bullet as the familiar 30-50 used by hunters no equipped with more up-to-date arms will not even dent the plate at this distance

the plate at this distance. The hole made by the armor-piercing bullet is, of course, merely the diameter of the core or miniature bullet in the case of our own, it is about 22 caliber or less than one-fourth inch. More behind the steel armor would therefore hove only 22-caliber holes quanties in them by the hard little missile. Such as bullet will easily panels through a full inch of ordinary

e of the tests made at the Small Arms Ballistic Station was to obtain the ballistics of our new armor-piercing bullet, and incidentally we tried it against

one of the armor plate on hand at the station.

One type had the miniature bullet or core, as it is known, made of Firth sterling steel, and the core itself weighed 90 grains. The other had the core made of tungsten alloy, weighing also 90 grains.
Using special heat-treated armor plate six-tenths

Using special neat-freshed armor plate ax-tenths in thisk, the Firth bullet put one over nearly through, slicking in the rear of the plate, while the other two rired, broke the back of the plate. The tungets alley over punched three clean holes through the plate. At 200 varies this tungetes over put a bad bulge in the road of the plate at the contract of the plate but the contract of the plate but the contract of the plate at the contract of the plate but the plate bu

The complete bullet well-hed 100 grains, as compared with 150 grains for the standard 30-caliber bullet, and was given a muszle speed of 2500 feet per second com pared with 2700 feet for the standard bullet. Both were, of course, to be used in the regular infantry rife and machine gun

You can imagine, therefore, what use an armored sult or armored car would be, if armor steel more than half an inch in thickness can be easily punctured by a little bullet any soldier may be carrying in his

be a little bullet say solider may be earrying in his control of the little bullet and the little bullet and the little to his about 20 pounds to be square foot. Modern high relectly sporting ride bullets will punch through a surprising amount of ordinary mild steel or bullet lenn, and the bullet the world bullet of the bullet lenn, and the bullet the little steel and factor. The little 87-scnin. 200 Stowys bullet, for fa-stance, will punch a bole through a half-lack mild steel pulset, where the 220-scnin. Kray bullet won't begin butter. The little 87-scnin. 200 stowys bullet won't begin butter. The little 87-scnin. 200 stowys bullet with the sport bullet when the sport bullet with the sport bu

to get through. Always the hole made by these high-velocity bullets is much larger than the bullet itself, and it does not seem to mat-ter in penetration whether the lead exposed at the point, or in full-jacketed with copper-nickel or copper I have seen a bullet of 28 inch caliber punch a hole through helf-inch steel, and the diameter of the hole was three-fourths inch instead of less than one-third, as was

less thus one-third, as was the bullet of the control of the cont

A Free Balloon Without Top-Valve

DURING the 140 years since Montgoliter invented the free balloon, comparatively few important improvements of the invention have been made. It is true that from the original free, drifting balloon, the dirigible that roun the original rees, arring nations, the dirightic halloon, more or less cigar-shaped, filled with hydrogen or hellum gas and equipped with motive power, has been worked, but there have been scarcely any changes in the free balloon. It is still of approximately spherical form, has a big escape valve at its apex, its ripping line and its rope harness from which the banket or ondola is suspended.

At last there seems to be a prospect of a material

At last there seems to be a prospect of a material improvement by abolishing the clumpy and troublesome exaps valve which rarely functioned properly and frequently was a source of great disconfort or danger to the serconauts. When it rained, water would accu-nulate in the seat of the valve and run down the filling number in the seat of the valve and run down the minus tube and on the heads of the occupants of the basket and their instruments when the release cord was pulled in cold weather the felt packing would freese, making it impossible to open the valve, or to close it after it has been opened.

In a recent German invention the hinged top valve is supplanted by a flexible tube, which reaches from the equator of the balloon to the filling tube at its lower the equator of the balloon to the filling tube at its dress of the balloon, passes with its outflow end through an opening in the balloon, passes with its outflow end through an opening in the balloon tiesue at the equator line and has, outside of the balloon, an extreasion consisting of a piece of very light tubing, about one foot long. The apiece of very light tubing, about one for long. The feeling tube which prevents the mouth of the tube consistency of the pass in the balloon. The stiffened end of the tube pass in the balloon. The stiffened end of the tube of the pole off the balloon to may desired being. When this is done, the gas believed the desired being, the passes of the pole of the balloon to may desired being. When this is done, the gas believed the desired being the pole of the pass believed to the tube free and of the tube relevance day will count to the tube of the tube of the contract of the cont

fare outward, thus ind cat-ing to the seronaut that the

er valuable impe ent, also by a German in-mitor, consists of a small clastic and bag, communicating with the indices and irovided with a whistle which gives a shi post presents an increase in the lease of gas, in deder Both inventions have been tyled out under actual flight con-ditions and were found to be



Left An nik-type arma-rejerring bullet and the steel core. Contro Steel pitch one tech thick, arm pierring bullet of An ealther, and these-senses tech bole breed through pitch. White strip is one by wide. Right: One-lach thick mild steel, slawring armor-pierring cores pretrading through St. N bow the core and the steel tools to wide.

Sunistrated Byes—A Film-Studio Problem
William one grosses one's skin to the rays of the
was, one gets sunburned. Some people are much
more susceptible to this than others, but everybody is
somewhat sunceptible. The cause is found, not in the
visible rays and not even in the radiant heat waves spany them, but in true light waves of such

that accompany them, but in true light waves of moch short length as to full in the invisible, ultra violet section of the spectrum. These have a powerful war and section of the spectrum was the same appearance of the spectrum was the same appearance of the spectrum was the same appearance of the same problem closely resultance of the same problem closely resultance that the same properties of the total Hands and face yet quickly accomplished to the same properties of the total Hands and face yet quickly accomplished to the same problem of the total Hands and face yet quickly accomplished to the same problem of the total Hands and face yet quickly accomplished to the same problem of the same p customed to this, and inducine to further burning just like the bronased life-guard at the beach. But the eye-ball is another proposition entirely. It is very send-tive to the ultra-violet burning, and it does not acquire immunity. The burning of the cychall by the ultra violet rays is a form of conjunctivitis. It is curable, but during the cure the patient must not be further exposed, and the eye is weakened by the fact of having seposed, and the eye is wateried to the incr of mixing been afflicted. This mailed, appears so freely among motion-picture actors—stars and supers alike—that a name, "Kielg eyes," has been coined for it.

name, "Kivig eyes," has been coined for it.
In response to the recent offer of one of the largest predicting companies, to pay \$5000 for a preventive predicting companies, to pay \$5000 for a preventive in the methods of film product inco., thousands of any gostions were submitted. A committee of scientists and practical undoin-prieture men candidred these aggregations with the utmost care, and carried out a good dead of research and experience in accordance with more promising schemes put before th

the more promising sciences pur before item. The experiments took two lines—medical and mechanical There appears no hope for a positive medical preventive A substance is known which, when put in the eyes, counteracts the bad effect of the ultra-violet rays. But with constant use this substance has a weakening effect upon the vision, and it must be used constantly, for the tears wash it out quickly Besides, five hundred people cannot be depended upon to bathe

are monred people cunnot be depended upon to nathe-their eyes, before each scene with any given substance — let alone one that is admitted to harm their eyes. It is, of course, absurd to talk of glasses to screen the offending rays from the players' eyes Many, film people wear dark glasses with the utmost faithfulness while waiting about a set in which the lights are burn

while waiting about a set in which the lights are burn ing, but no sire, and precious few extrus, can wear glasses in the face of the cumera. This brings us to the proposition This brings us to the proposition of the dimension waves and letting the others through. The difficulty waves and letting the others through. The difficulty waves and letting the others through. The difficulty waves and letting the others through The difficulty have is that glass is very far from 100 per cent trans-parent, at its best. Plain window glass reduces the photographic ray 50 per cent, round glass 40 per cent, and Flueratine glass 50 per cent. If the camera man sets up a acress for the ultra violet, it will therefore cut off so much of the rays that he needs in his business that he must use two lamps where before he used only ope. He will then find that the two lamps with the reens will supply as much ultra violet to the set as one lamp without the protective glass. This applies with plain glass, colored glass of any sort would obviously

make the matter even wors In view of all these con siderations, it appears that the solution, if there be one, lies in the film. A film would be needed that would work as effectively and as fast in a subdued light as the present films work in the g The laboratory men of the film company carrying out the investigation are now ex nenting with a ne w type of film, in the hope of me ing this requirement Whether they are immediately successful or not, in

this direction, appears to lie the only promise of relief for the film artist At present, two types of illuminant are employed in the motion picture studios, namely, the mercury vapor tubes and the finning area. Both generate a very large per centage of ultra violet light which is highly actinic. The electric power consumed may run anywhere from if kilowatts to several hundred kilowatts for a single set



" transmitter, acting through current, without any membranes, etc., as in the

Long-Distance Concerts in Germany

GERMAN, which so far was deprived of the bless-ings of radio music, has at last enjoyed her first radio or rather "remote" concert, for those responsible for the demonstration found it—for purely practical reasons—more convenient to use a transmission line

for this first exhibition their scheme, installing the artists in another wing of the same building rather than at a far away radio station Anyhow, this con-cert, which our Berlin cor-respondent had the good fortune to attend proved a conclusive demonstration of the possibilities of a dethe possibilities of a de-cidedly new arrangement which it is hoped affords the definite solution of the loud-speaker problem

However, even apart from the loud speaker, the scheme markable new apparatus, of which the more important are described in the follow

First, attention should be frist, attention should be drawn to a novel microphone or Cathodophone, as the in ventors, Joseph Massolle, Hans Vogt and Dr J Engl, have dubbed it, and which is based on the following prin



Group of the new loud-speakers, based upon the principle of the electrostatic telephone

c,g, that of a Nernst lamp, lonizes the air surrounding it, i,c, makes it conductive. When a small amode tube fitted with an acoustic funnel, is introduced into this ionized air, the anode voltage being about two to three bundred volts, an ionization current will flow toward the anode the intensity of which is acted upon by any fluctuation in gas pressure in the neighborhood σ gby fluctuations set up by sound waves, caught in funnel thus superimposing an alternating current corresponding to acoustic variations over the ionization current. The most remarkable feature of this alternaturrent. The most remarkable feature of this alternative current is the absence of any mechanical links, mentionizes, cit on in the case of the ordinary or continuous continuous

fier, in the construction of which all selective influences were eliminated, such as are usually insparable from were cuminated, such as are usually map parable from oscillatory circuits, having a period of the row within the range of sound frequencies. Phis is a low-fre-quency three-tube amplifier, the coupling of the ele-ments of which is effected without any self-induction It will amplify currents of an intensity not higher th say, 000 000,1 ampere, such as the most sensitive tele-phone is barely able to perceive, to about 10 waits of vibrating energy all frequencies within the acoustic runge, i.e., those varying from 50-25 000, being dealt

with exactly in the same manner

It will be readily understood that in order to solve this gigantic task special types of vacuum tubes had to be developed. In fact, the inventors have been successful in providing decidedly novel amplifier tubes, based on the use of mica, which possess a number of

based on the use or men, who present additional advantages.

The third apparatus designed by the inventors is a most loud-speaker or statophone, as it is called, which effects an incomparably purer reproduction than any other type used for radio reciption. It is based on the principle of the electrostatic telephone, which old as it is, has so far been absolutely neglected by electrical engineers, and which in the present case, proves cupa-

ble of unsuspected possibilities.

The new telephone is made of metal and mica throughout and is about \$0.40 centimeters in diameter.
The stationary armature has for the sake of damping The stationary arouture has for the sake of damping been subdivided the anotherine being divided into several eccunite rings, so that any position of reson-ance as characteristic of other vibratory arrangements, is done away with in fact, the new telephone within is done away with in fact, the new telephone within the range of frequency for which it was designed com-prises all possible position, t.e., no special position of resonance at all. There is thus within the accountle scale no maximum and no material fluctuation in the tends of reproduction

The efficiency of the new electrostatic telephone is especially satisfactors, any iron and copper lossus as well as losses due to stray currents, as inseparable from the usual or magnetic type of telephone, being strictly

An amount of energy of only about three watts, such as developed by a few pocket lamps, proved sufficient to fill one of the largest music halls of Berlin with such a volume of sound as to enable the musical perfor mance to be heard with practically natural intensity even from the remotest seats. The quality of reader lugs, of course, to some degree depends on the kind of nge, or course, to some negree depends on the kind of instrument or in the case of song and recitation on the pitch of voice, but on the whole, was remarkably natis-factory and lumensely superior to those effected by the usual type of loud speaker

It is interesting to note that the apparatus here deit is interesting to note that the apparatus here de-scribed has been used in connection with a new system of talking motion pictures, which attracted a good deal of attention in Germany. Indeed the main fulling of talk-ing pictures in the past has been the lack of realism, and this improved apparatus should prive a forward step.



He first indicated spectacles are the only means known to protect the eyes against the infirm-rislet raps in the camera man's are light; and these would hardly go on the firs

When Water Power Paves the

How the Town of Lawrenceburg Discovered a "Mint"

By Lutell McClung

AHF indeed is the town or city that "coins menty for tiself, yet this is just what the little community of Lawrencehurg, Tennessee, resuly does. The energy for such operation is generated by a large rreck that flows close to the town, and the money coining equipment consists of a concrete dam,

and water tower Many communities have these facilities. Yet it has remained for little but enterprising Lawrenceburg to demonstrate that a public's owned and honestly-oper-ated water power plant can liquidate its municipal debt, nted water power plant can liquidate (to munk) and debt, pps, for public hiprocussories, and at the same time pps, for public hiprocussories, and at the same time at surprisingly low cost. Law crack-targ its small, and, anturnilly fits water mind te sould in propertion—less than 'Who however in fact. But she has radding to the many low properties of the properties of the many low properties of the properties of a number of faries ethies called athew the same results for index out in assuring and the form ethicus, if they followed this Law one burg method. There's he no bagger any doubt that both principle and method are sound for

everybody concerned. Not only does Lawrenceburg secure its street light ing and water for fire protection without charge, but the profits from its municipal hydro-power plant have the prime from its numerical nyan-power pain may pull off the old floating debt of the community. And, in addition, these profits pay for both street and side-walk paying. There are no assessments and no taxes for paying not a penny do the people pay directly for

any of these improvemen The writer does not know of any other community that guite matches this

Lawrenceburg is one place that has declared its inde-pendence of coal if not penuance of coal if not even a single pound of coal were ever brought into the town, its "white coal" would continue to turn the wheels of its industries, illuminate the streets and supply water us well as light and heat the homes. Today the municipal its itself does not buy coul of any kind It never needs any

While this progressive town is giving its citizens such service and improving its structs without for or less, it is selling current for

less than 4 cents a kilowatt for hour. It is selling water for 20 and 15 cents a thousand gallons. And with this low cost service and with the profits that acrose there is still adequate allowance for the upkeep and operation of its hydro power plant and for the extension of service

and interest on the money invested
"This little project of ours is a mint simply a mint," anys E. P Proper or ourself miner simply a mine, says E. P Vixon its superintendent "it goes right on working for the people at lows at possible cost and with out any waste. It is permanent and we are all very proud of it. We have something to show visitors that other communities haven't got-but might have What would it cost if we went back to using coal? I don't know, I don't want to think about it-we would run so deep into debt"

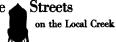
This money-saving, money making, service-giving little municipal plant is made possible by Shoul Creek along which Davy Crockett, here of the Alamo, once hunted hears and fought indians. For many years Lawrenceburg was the home of this intrepld spirit, and it was from Lawrenceburg that he

set forth for Texas and his last, and battling the Mexicans with the butt There is an 18-foot days Ald foot

long on Shoul Creek From the dam extends a tunnel 10 feet square through solid limestone to an out through solid limestone to an out let on the creek lower down. The 18-foot high dam and the 18-foot

full in the tunnel give a head of 30 fe fall in his turned give a head of 30 feet. The power-bouse and turbines are, of course, at the outlet of the itume through the rock. This little plant is located about three miles distant from town During the day the power is used by Industries—hosier; mill, shuttle-block factory creamory, ice plant, flour mill, machine the properties of the plant for the plant for the plant of the factory creamory, ice plant, flour mill, machine shops garages, printing offices, etc. In the early part of the night the current, naturally, is taken by the homes. In the latter part of the night and in the early morning the energy from the turbines pumps water for

Thus the consumption of power is evenly distributed over the 21 hours and admirably balanced to neet domestic and factory needs. The water supply is a



electric names

in a number of dependable contracts for power Threa demand steadily increased. Today, Law-rencebury home owners not only sayly low-cut lighting but a number have electrical besters, ranges and other appliances for herbing water, wauking clothes and disbess, seven-ing, set yet their meanthy bits for power is said homestly by thermelves to the their contractions of the power is said homestly by thermelves to the their contractions of the power is said homestly by thermelves to the their contractions of the power is said homestly by thermelves to the their contractions of the power is said homestly by the cut-les with the contraction of the power is said homestly by the cut-posits from this unusual caterprise in the citizen themselves.

but the citizens themselves.

In time profits began to accumulate
and there was question of what to do with this surplus revenue. was decided that it could best be

spent in street paving And so this work was started. It is well under way and will continue until all the broad streets are paved and other numelical improvements made. The town is growing rapidly and the streets will be extended and paved into new residential sections. The very fact that Lawrenceburg has cheap current for houses and industries

renectory has theap current for non-leading attracted many new reddents.

As may be supposed, the time came when power demands were greater than the supply. Now the town begoing further down on the creek to build another dam going rurner down at the creek to built and are and This second numbiguily-owned operation will be inter-cunnected with the first, and there will be sufficient power to take care of the new industries and residents. But the time will come when even this operation will not

be sufficient for the growing population and new factories — growth caused directly

— growth caused directly
by honest, efficient municipally owned hydro-power
service. The people realize
this and are now looking beyoud their second plant They intend to go further away to a large power stream and energy will build a real city at Lawrenceburg They have realized that a community can be built anywhere if hydro-power is harnessed and distributed to the people

ened several times is that of the plant falling into private or corporate hands, with the



that builds up continuous interest charges and give opportunity for enormous profits to a few individu opportunity now entormous promis to a rew institutuous so There are doscuns of towns in that section of the coun-try that are supplied by current generated from water-power. But all except Laurenceburg pay high pelces for service and large and centineous profits to the corporations that are heavily capitalized and beavily

bonded
Lawrencehurg has fought safely through this danger
and the people new would not sell their little "watermint" to anybody for any sum. They not only want
it for its continuous and direct benefits to themselves, but for the example it sets to other towns and citic located where hydro-power is available.



Left Power house of 306 horsepower, which supplies Lawrenceburg with power and light. Right Dam for the power house, measuring 18 feet high by 204 feet long

huge, clear spring just a short distance from town Here are installed two electrical pumps, operating on the power from the turbines two miles away and lift-ing the water into a large storage tank that gives necessar) pressure for domestic and industrial uses and for

When the Lawrenceburg plant was first established as municipal operation, it was not an immediate success. a municipal operation, it was not an immediate success. For some time there were not many buyers of current. The town was in debt and the possimilate said that the cost of the plant only added to the debt. Inducements were offered to establish the project on a paying basis. The town agreed to wire houses and business houses and to supply electrical equipment at cost. This brought





What hydroelectric power, municipally owned and operated, did for Lawrenceburg The first view shows the original state of the streets, while the second shows the present appearance of the residential streets



Barge lead of bouses on route across the Kanawi River

House-Moving by Ferry

GOMETHING different overy day is simone certain. To to the bet of the man who makes the mosting of houses his profession. It is no longer a next sight of the mass has made the second of the second o

upon the errors or maintained by the being charred for the new Matte Capitol, and their owners saved a very confortable sum by moving them to new locations as against the cost of rebuilding. Thirty two houses in all are being moved, but of these and twelve has been obliged to find new stees on the far side of the river

A Machine for Sowing Seed by Hand

A MOA't interesting, does not increase of the post A MOA't interesting, does not increase of the post A war period, few are of nurse direct practical applications than the seed growing device which we libraries sowing must librar are for the most part inclined to what size and costilitiess, for the small undewere or tennative to hand sowing, with the tregularity of distribution that must necessarily accompany it. The sturyl application of our photograph, however, has only to along the study of the study of the study of along the study of the showing with the other to lineare an even allottened of his seed until the supply in his bug is exhausted



Hand-sewing of tood by use of a device that lasures uniform distribution

The Rotary Plow

WHAT is phoreign? Since thousands of years the farmer has been accutioned to regard the necessary annual loosening and remixing of the said as being practicable on a large scale with one implement afone, providing the said of the said as being a substitution of the said of the said

the horizontal agrees. As the term in the to done in this fluid playing down and at the a, which, different principle from the old turn-play which, however, fully new feeded during the last free deep down which, however, fully new feeded during the last free deep down and the free certain short countings that are fundamental, the rotary play invented by Fetcher T Hamshaw of Seattle, Wand, accomplishes the destreed results, according to the claims of the inventor in a better nummer. In addition it performs at the single playing, according to the equations, and are rolling, disting horizontal pulse visiting, and, if desired, drilling, in the sext not it passes, and in present the player of the photograph of the rotary play.

An inspection of the photograph of the rotary plots in sputia, such is have the impression that it is a kind of tractor, an impression also in both appearance of the forward purish. But not the daws nothing it cannot be carbed a tractor of the secondary in the secondary in the carbon and th

may plonting.

The entire lamplement, which weights 0900 pounds, is driven by a 4-5-hers power goodine engine of the tractice parts of the parts of

ground at the rate of about 3½, ables per hour.

The dimnet ro of the hig dront, 144 line has a The dimnet ro of the hig dront, 144 line has a distinct to a sight of 18 inches. This great depth of plowing is one of the sulfant features of the 2ax implement it brings up at least six in less of subsell that has never and high, and it thus introduces not only a new secdied of litheret on must odd but a subsell was so incking in human that the framers should be very cautious in beinging much of it to the surface and any single years plowing. It was frequently stated during the war that the soil of be same would prove the any single year plowing. It was frequently stated during the war that the soil of be same would prove in the surface of the surface of the surface when the reaches framer came to try crops on such soil, thus "naking the soil" instead of the theory, he discovered that the new yields were very much heather converted that the new yields were very much heather converted that the surface of the theory, he discovered that the new yields were very much heather converted that the new yields were very much heather conventions.

In the case of the rotary plow, which regularly plows to a depth of 13 inches and has penetrated to 1st check tests between soil thus plowed and that done with the turnplow have demonstrated that croppages have been more than doubled in some cases.

the more man assured as a second of the control of

are incorporated any primary interest increases and are removed depth than is possible by respected disking, giving a very uniform distribution from top to bottom.

The rotary plow is not intually off or use in stony asil, where the budges are soon spaties, but is the stony asil, where the budges are soon spaties, but is the time badge are soon as a single state of the stony asily as the state of the stat



The rotary plow that converts virgin soil into see bed in a single operation

roots are very large, very lough and they permeate the soil in all directions. The rotary plow makes short work of then skiling the matted roots into small pieces and leaving them in the soil to deary and provide where food.

Thus it Is seen that in wer methods may be brought to be are on the ora annual operation that for the assents work former is the most laberdone of all the seconds work of the second probability of this growt age via tage effects has shown that the American furture be for no means show to adopt the the American furture is no means show to adopt the second work of the second that the American furture is the second work of the sec

Making Lightning for the Films

Analogy Joyathan got the remaindent property of the property o



Artificial lightning for the movies is produced with



Left Kalmia initfolia or broad-leafed laurel, which is sometimes mistaken for wintergreen. Cessor: Delphinum ajacia. Right: Atropa balladonna, the deadly nightshade. Three of its berries contain sufficient poince to cause violent symptoms

Poisonous Plants of the Garden

Danger Which Lurks in the Pretty Flowers and Berries Picked at Random

T Is an armed time which exists between the plant and the animal kingdoms Vege-tarians, especially the more hoggish kinds, attack plants and voraciously gulp them down from leaf to stem. As a means of preservation against such willful and un necessary wholesale destruction many ingenious

becomes whole-side that ractions many impositions pre-terily to device are employed to the plant and of those the more important are corrowive fluidle and poleons. Not only those substances which, in infinitesimal of the plant of the plant of the plant of the plant and the all those many changed respectively and the plant cutting animals are furded. These, the true, only form a very small part of the known toyle, poleons, which all subsuch this you be harmless to see substances Certain plants seere to certain wit donned polyons, which although they may be harmloss to one animal, are intensely took to another species. Many plants are more or loss protected by such secretions from total destruction through over voraclous animals, but the toxin cannot be considered as a protective medium since the plant does not produce it for this special purpose. It is only a product of metabolism and that the plant has finally changed this substance chemically for its own protection can hardly be seen

support of such a theory
In all probability each flower has its own poison in the broadest senses of which we know nothing nor which we can recognize Grazing stock usually despise floral envelops but eat the leaves. On the other hand, therst envelops but ent the leaves. On the office hand, they curfully leave certain plants severely alone, at though they have no perceptible odor nor have the, any special characteristic which would lead one to suspect hidden twic prespective. Something must be wrong with them, something

most be velled from an r tune in ind session above. rate it is perceptible to the

Plant poisons as built up by mature, chiefly consist of carbon hidrogen oxigen and often the mert nitrogen a substance which in itself is very inactive and sluggish but united with other clements gives us not only beneficial but also very harmful and dangerous com pounds. Then, too sulfur nury be present, as well as a few metals, the most in portant of which is potas-sium, but these are quite rare in occurrence. This rare in occurrence This hullding material is also used for the formation of the entire plant, from grasses to the mightlest of oaks. Certainly it is a mar

sclous power inherent in the plant which enables it to produce all those materials found in it, the various poisons themselves only being a tiny fraction of the existing compounds.

The action of the different types of poison on the organism are peculiarly distinctive. Each one has it organism are peculiarly (maintive, foach one must now symptoms. Some only react when they come in direct contact with the blood vessels, being fatal in almost inflational quantities. Otherwise lave has opportunities to power under such a condition. They are most theorems when they reach the stometh, where they produce the most serious of disturbances.

produce the most serious of disturbances.
Although polsonous sulmais are seldom mistaken for harmless crentures, such a definite classification can-not be given to the plants. In fact, a large number of them are similar to the most common of kitchen of them are similar to the most common of kittlen-herls and edible plants. Others, again produce fruit, which, in appearance, seem to be tast; and delicate, but in reality are most dangerous. Such headlines as "Polesmons mushrooms cause death," and "Children die enting polesnous berries" are only too often found

one enting poisonaiss berries are only too trea round in the dully papers.

No method is known by which the character of a poisonaous sussificous and be determined. The only protection available is the personal picking of the wild species and the absolute tregutable knowledge of the character of such individual amphroom picked. Formerly, two types of mushroom poisoning were differen-tiated one a nurcotic and the other a digestive disturbance light a mytoms often interminale the effects taking place a few hours after eating. There are a for methods by which the toxic effects can be removed in all probability, all polsonous species can be rendered edible by first digesting in vinegar and sait, then boiling

for some time in water, and discarding the holied water Dalible annularous sometimes produce symptotics of mankroom principles, especially when they are are not well of the product of decay somewhat water they are not been decay to be a some progrand at once, and the product of decay somewhat rewenthes principle it is not at least of the product of decay somewhat rewenthes principle it is not all neversary first such decay be accompanied by a least never an uncoverse than undertoon poissing it is prisonling through herries. Children often on those of sirops beliednam, the decayly alghithidae Even throw of these berries contain sufficient joined to come violent to the best of these berries contain sufficient joined to come violent to have the second of the selection of the selvery glands in his part and drops the action of the salvary glands in his part and drops the action of the salvary glands in his part of the principle selection. The junes were derived to the product of the salvary glands, was introduced by g justes who considered it their 'personal' justes in Beddes the total carepins, bysegranila, byon ine and several other alkatidids are greens. The product of the plants with the product of the plant with the product of the plant with the product of the plants with the product of the plant with interest of the plant with interest of the plant with interest producing occur but rarely In the latter case an indirect polemning may take place. Large cellbe small information to the plant with interest the production. The total conditions, polemous. Then, too, children of the control of the plant with interest in the plants.

this laurel for wintergreen (Gentifierie pronumbens) and are polaceed.

The common nightshade, (Solessen signism), with its black toxic berries, which are often eaten by children, opens its small flowers dur-mal Tolly August and Sanad death often on



Left: Datura stramonium, or finance wood or thorn apple, which contains powerful affinished polessus. Conter: Solanum nigram, which has black taxic berries often eaten by children. Right: Digitalis purpares, otherwise known as fax gives

Shoping Railroad Coaches to Save Time

Disputed mainteen control to David Alexen THE conditions and requirements of railway travel I vary in different countries in many respects, and to an extent that would surprise the uninitiated. A few words explaining the reason for the slipping of passet participation and the properties of the condition of the countries of the

be assists. It sometimes happens, in the case of a long-distance, non-stop run to a certain destination, that a full train of case is 40 required, in other words, that there is required, and the words, that there is it may be expedient to maintain a certain service to other stations, either intermediate or on branch lines, trainferentiations are requirements would not warrant running separate trains on gifteness to such destinations, as frequently as

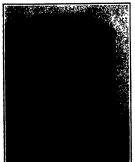
long distances to such destinations, as frequently as neglectual and a supplied of the such as the such as the such as the such as many as the such as new portions in such a manner that while the front centinues its journey unbindered, the susuinder, under continues its journey unbindered, the susuinder, under the such as the such as such as such as the such as such a

scoping the water train.

This method is employed by a number of English railroads, notably the Grent Western, the Grent Eastern and the North Western lines. It is effected so easily that passengers in the ellipsed portion of a train, alight ing when it shops, have no idea that the locomotive with the front portion, is speeding on its journey several miles ahead.

unifice about of the control of the large of the control of the co

There are several different types of silp couplings to use, of which it will be sufficient to describe those employed on the Great Western and Great Eastern artifered in Bagiand. In these the drawker is fromed respectively to the several several several several a horizontal pin, so that when free the hook pertia a horizontal pin, so that when free the hook pertia sevings downward, but when first it serves exactly the sear from our librartical and that the end of the movuble sear from our librartical and that the end of the movuble sear from our librartical search and the end of the movuble takes as inclined seating on the aboutley, the upper claps of the end ping horizontally and dush with a packing on top of the shoulder Bound the latter is an inverted U strap secured to the shoulder so as to



and of car equipped for ally coupling. Note the link which degages with ally coupling shown in other views

leave a hole or slot above the end of the hook. In this dot, a horizontal case-hardened locking bar is fitted, extending to the inside of the guard's van where it is plrotted to a hand lever, the upper end of which may either be held in position by a pin or secured by a spring

eatch in the stor of a quadrant. To couple up the relicies, the lever is pulled forward, thus withdrawing the locking bar and allowing the hook to open out. The ordinary coupling shackle of the other coach is then little distribution, the hook is blinged back round it, and the lockin, bar le shot forward, thus effectively, securing it.

To slip a coach, the guard flort closes the cocks in the brake place, and then pulls forward his lever, thereby releasing the book which fails downward. Immediately the shackle in the coupling of the other vehicle falls out, and the whole coupling swings downward, thus severing the cuancetton completely so that the rear coaches begin to lag behind those in front, which coacoaches begin to lag behind those in front, which coa-

tinue their journe; with unabated speed
The slip coupling should be at least as readily applicable to the American type of automatic coupler as
to the English type

to the English type
Take the case of the automatic coupler on vestibulcoaches, operated by a lever under the coupling apparently it is only necessary to introduce a few belcrank and other levers, including an operator a lever in
the guard a van similar to the English type, to reader



Slip coupling, shown above, in the open position, with link released and out of picture

the slipping of couches on American trains a very simple operation indeed And it is on its face a very profitable one. It is indulged in so freely in England that, when one takes an express train from any of the larger Lonce takes an express train from any of the larger Lonquite certain that one is in a car destined for the point to which nowly ticker words. Julling this precuration, one is likely to find enseed for maturely, shunder about have been about the point a which one should have been shunter!

Use of Kilocycles in Radio

THE Second National Radio (vanfrance, which was bed inst March, introduced a method of designating radio waves, which is somewhat new to the radio public This is the use of frequency in kine value (abeviated (ke) instead of wave freight in metrs. The advantages of this practice have been familiar to radio on gineers for some time, and it is probable that it that a sunter of fact, wave length is a somewhat artificial conception in the handling of radio apparatu and is one of the difficult things for the beginner to understand. The frequency of the radio wave is the same as the frequency of the public wave is the

and is one of the difficult things for the beginner to understand. The frequency of the rulion wave is the same as the frequency of the alternative current which the same is the frequency of the alternative control of As often happens in technical matters, the idea of "kilocycless" is simpler than the forbidding aspect of the word suggests. "Killo" means at thousand and "vice" means one complete alternation. The number of kilocycless is the same of the same of the control of means one complete alternation. The number of kiloments are same of the same of the same of the means of the same of the same of the same of the direction in the anteens in one sevend. The smaller the wave length in meters, the larger is the frequency in

The reason that kilocycles are coming into use and displacing meters is that the necessary separation of the frequency of trunsmitting stations to prevent interference is the same, no matter what the frequency may be. This necessary separation is variable and



Slip coupling in use on great Eastern Railway in England, shown closed

quite misleuding whee expressed in meters. Thus the number of rails of messages that can be transmitted simultaneously without interference can be correctly ladged from the thie-se'es but not from the meters, ladged from the thie-se'es but not from the meters, but this band of wave lengths from 120 to 300 meters, but this is a frequency bund from 200 to 1930 kilovictos. This is an energy of the contraction of the condition of the hardy the manner within the condition of the conlaring the same width in meter from 100 to 1000 meters, which is 90 to 280 kilocytes. While it is possible to carry on 99 simultaneous radio telephone communications between 170 and 230 meters duly one communications between 170 and 230 meters and the contraction of the contraction of the contraction of the section of the contraction of the contraction of the section of the contraction of the contracti

In accordance with the recommendation of the Second National Hondis Conference the Dispariment of Commercy and other Government departments will become folions the practice of specifying in cven values of Kilicy idea rather than morters. The conference recommendation of the Conference of the Confere

Types of Aeronautic Instruments

THE Bureau of Standards has just issued Technologic. Opper No. 237 or "Types of Aromattic Instruments." Opies can be obtained from the Superintendent of Documents Government Printing Office, Washington, D. C., at 20 cents each.

This paper dose ribes the various instruments ordinarily need on the moden aircraft and will be found useful to all those interested in the aeronautic instruments are the instruments condition of the interments in the interest of instruments, include the interments in the interment in the inter

Among the special instruments and accessories described in this paper are oxygen instruments, recording instruments, strat and gas temperature theremoreters, persistent of the surrounding air while gas theremoneters are employed on lighter-than-air craft to give the temperature of the gas in the bag. Other instruments on nearly all alrevart and which must be capable of withstanding shocks of landing and severe vibration, manometers and hydrogen leak detectors, employed of gas in the bag and to indicate the leakage.

The paper is profusely illustrated with photographs of the latest types of aeronautic instruments.

The Wembley Park Stadium

Built in London, the Largest Sports Arena to Date, with a Capacity of 125,200 People

By P. J. Risdon



IANKS to the courtest of the manage-INAYAN to the courteer or the limings-must, we have been enabled to compile from first hand large relations some later esting purituals of Wembley Park Mu-dium, the greatest stadium and sports arean in the world, which has recently been compiled in London at a cost of \$1,500,000

896 ft. 696 ft. 681 ft x 820 ft. 492 ft x 260 ft. 860 ft x 240 ft.

125 200

The arean and ampitheure buildings, with their immense accommodation for spectators and players. occupy a total area of 12 acres The seating accommo-

dution provides for 24 586 speciators under cover and a further 9700 in the open, the total scating and stand ing capacity being 125,201-50 per cent greater than 80000 credited to the Roman Colosseum though many authorities believe it beld nearer 50,000 than 80 000 In addition there is necommodation for the con venience and comfort o athletes, including dressing, massage and bath rooms, gromasium fully equipped with modern ap-paratus, and a large revea tion room with billiard and tion room with billiard and writing tables. Access to the grand stands and to all parts of the stadium is gained from a wide circulating corridor, wide enough for 24 persons abreast, with

corridor gangways and double stairways at frequent in terrals leading to all parts of the stadium. The following is an interesting comparison with the Colosseum at Rome

The outer wall of the is carried on 37 arches, each 45 feet high and 50 span The structure is built almost entirely of steel and concrete and comprises 40 miles of terracing Aith there is little risk of fire, ample provision is made to cope with an outbreak. On e north front, overlooking the exhibition grounds, are two concrete towers 106 feet high each surmounted by a reinforced concrete flagstuff

The area of the stadium playing field and the run ning tracks-has been prepared under the supervision of Mr Charles Perry who has been responsible for the construction of all Olympic playing fields and tracks since the reorganization of the Olympic games in 1006 in Athens.

in Athens.

It was devided by deal with the studium at Ween bley in very much the same way as that at Stockholm had been treated, and that the foundation of the should be so shaped as to form a natural draining system. To this end a fall was almoved for, from the evider of the areas to the outside the outside the outside the state of the state of the state of the state of the outside the outside the state of the state of the outside the state of the state of the outside the outside the state of the state of the outside the outside the state of the state of the outside the out edge all round the playing field of at least six inches, to allow the water to run away On the clay foundation, various grades of cinders

and ellaker sish were laid to a depth of ten inches, and over this again five inches of specially prepared soil was spread to form the natural hed of the turf Wembley Park, before it was taken over by the ex

hibition authorities, had been occupied for 12 years by the Wembley Park Golf Club. In April, 1922, when by the Weinbley Park Coff Club. In April, 1922, When the exhibition authorities took over the park from these owners, as many of the fairways and putting greens as could be sparred by the contractors were railed off, and put under cultivation. These greens were dressed,

and put under cultivation. These greens were dressed, rolled and cut, and generally treated, in order to pro-duce by September the very best turf possible. On September 6 a large portion of the arena was ready for turing, and the cutting and transferring of this

The live load test of the stadium by 1200 fx-service men, who rose and sat down suddenly en masse, marked time, awayed from left to right and backward and forward. Readings of the effects were taken

turf was begun. The turf was cut in dominoes, 18 inches by 12 inches, and 2½ inches thick, and these were placed on flat skips and taken by a small gage. railway into the stadium. Here they were unloaded and relaid immediately. The grass never ceased grow made by which, on each day, no more turf was cut then could be successfully hald on that day. The turf

ing The work was so organized that the turf was laid st as son as it was cut, and arrangements were laying was completed by October 6, and two weeks



General view of the Wembley Stadium along its longer axis. Over-all longth 896 feet, breadth 605 feet. The arena, 621 feet by 320 feet, may be compared with the Colosseum, Rom-feet. Total capacity, seated and standing, 125,200

later, owing to the excellent way it had been knitting, the grass had to be cut. The result is that there is now a football ground composed of a grass so tough, that it will withstand the wear and tear of a season's foothall and yet remain as green at the end of the season as at the beginning.

The arena is too rece above sea ever, and stands on the highest point within the exhibition ground. The sub-soil is heavy clay. The system adopted, therefore, was to prepare the foundation of the arena so that there was a drop of six inches in the clay formation.

from the major axis of the stadium to the running track, and then, in addition, there was a drop at each end of the arena from the position at which the goal posts would be placed, toward the track.

posts would be placed, toward the track.

There are two running tracts, one skirting the playing field being a circular quarter-nile lap, while the other gives a farsight 250 yards spirat. The straight is made possible by tunneling under the west-end bank of the studium, or but the runners will begin the distance out of sight, but will emerge from the 50 yard to the contract of the studium of the studium of the studium of the studium of the studies of the studium of the studies of

the suscintors. Some of the more recent sports grou feature, but until now there has been no stadium in Europe with a 220 yards

atraight
It is fully expected that
the trucks will become the
fastest running courses in
the world, and that new reords will be set up. In the "220 straight" the absence of corners or curves will be a great advantage to the athlete He will not need to bend in with the curve of the course, and again, the ruce will be more truly run because the serious disad vantage of not being ahead when the first corner is reached will be done away with

The tests of the studium were very exhaustive The first stage, by means of dead loads, was of a rig-orous character Various sections were selected and The first strate, by hundre of dead loads, was of a rig-orous character Various sections were selected and tested separately. The area of the first section tested was 80 feet by 35 feet. Five thousand buys of sand, out h weighting one hundredweight, were placed on the sexts, giving a total load of 250 tens. The senting arrangements of this section will accommodate 850 of the loads of the section will accommodate 850 of the loads of the section will be only about 90 tens. arrange costs.

people whose total weight would be only about 60 tons.

Thus a large margin of security was revealed by the test, for the test load ap-

piled would have to be quadrupled before the structure

The live load tests were carried out by 1200 selected ex-service men, employes of Messrs. Sir Robert McAlpine Sons, who built the mation, the men marched up to the grand staircase of the studium to that section of the stands immediately behind the royal enclosure Here they engaged in various movements — rising quickly es masse, sitting quickly, marking time, swaying from left to right, and forward and backward. torward and backward, cheering and stampeding. These movements were repeated on other sections of the stands, and the chartesdings taken by the engineers during the testamowed variations greatly b those anticipated w

Standard Boxes for Hoslery Standard Boxes for Hoskiyyi

"THE textile section of the Boxes for Hoskiyyi
THE textile section of the Boxes of Signaforth has a nearly dompleted the development of sandard boys
for partial professor. This has resulted in the reducella
of suproximately Box of inferent gives to both of standard
and actual packings will be usade at the Burney After
Shar check determination, the project only be considered
complete, and it is elepated that it will result in glac
sarding of a very large amount of money to the hosking
industry.



Two cars comprising the instruction train employed by a French railway for breaking in new men and perfecting old railway employes in their work

A Traveling School for Railway Men

IN solving the problem of breaking in new men into the ways and means of railroading, the Paris and Orleans railway of France has developed an ingenious traveling school, which forms the subject the accompanying illustrations. school consists of two instruction cars, per manently coupled together and provided with a telescopic vestibule so as to form a with a talescopic vestibute so as to form a single unit. The care contain a vast array of equipment for the handling of classes. One of the conches is a typical French four-wheeled baggage car, while the other—an eight wheeled affair—is known as an Amer

lean type car Perhaps the most obvious feature of the traveling railroad school is the large col-lection of working models. On one side of one of the coaches there are various valve and driving rod movements mounted in such a manner that they may be actuated by crank A few moments' study of one of these models will teach far more than many hours' study of diagrams and text. Then there are models of the various types of

inere are mouest of the various types of compressed air brake systems, with some of the parts broken away to facilitate study.

In one of the cars, suspended from the ceiling by means of cubles, there is a table with a complete lay out of minimure tracks switches and signalling system. This piece of equipment is employed.

tem This piece of equipment is employed to teach embryonic railway men the essentials of railroading. The miniature railway comprises four stations with double tracks, four stations with single track, many switches and cross-overs, and 137 various kinds of signals. The table is counterweighted in such a manner that when it is not required it can be pushed up toward the ceiling and out of the way



Typical model of compressed air brake equipment, with some of the parts

In fact the same iden is employed throughout so as to use the available space to the best possible advan-inge. Tables, hinged at one end can be folded down against the wall and out of the way when not in use The breaking in of new men on ratiroads, or any

other public service enterprise where their unavoldable in the lener would constitute a menace to the life of the patrons, is always a ticklish problem. It is one that cannot be avoided however and the French have made a very intelligent attack upon it.

Standardization of Wood Screws

A T least two systems of numbering wood screws to designate the diameter have been used in the past methods of measuring, length have been hopelessly at variance and the number of threads per inch for a given size has not been the same for different makes. All this confusion has been eliminated and the dimensions of wood ws made uniform throughout the United Strices as the result of a cooperative agree-ment among the manufacturers, the Bu-reau of Mandards and the technical section on builders hardware of the Federal Speci-fications Board

neutrons fourd. The system of numbering to be used henceforth is the same as that now employed in designating machine serve sizes, except that diameters above No. 12 are also designated by numbers. This means for example that a No. 10 wood serve will have

the same diameter as a No 10 machine screw. Uniform methods of measuring diameter and length and uniform tolerances in these dimensions were adopted together with a standard angle for the under side of the heads of that and oval head serees. The number of sizes of brass and steel serees manufactured as

standard was reduced from 555 to 291 a reduction of 47 per cent, while at the same time retaining a sufficient variety for every need. This reduction should benefit the

manufacturer, the dealer and the user Circular No 140 of the Bureau of Stand ards describing this work has just been issued and can be obtained from the Gov



When Wood Shrinks

What the Camera Has to Report Regarding the Changes Taking Place During Seasoning

By B. B. Borchers Forest Products Laboratory Staff



III, moti a picture camera and the micro seels to note made the first moving ple wood when it dries For eighteen hours,

light flashed upon a drying bit of red oak and every time the light finshed the camera clicked set at a microscope forused on the small block of wood the camera recorded each change as the wood

wood the camera recorded such change as the wood gave up its holsture by M. I. Diemer photographer at the Lerest Products Luboratory of the United States Lorest Service much the film which is only one of a series by hopes some day will be made

Physicists have known in a general way that shrink-ing and swelling always accompany melsture changes in word sold Dr. Diemer. The film records graph in word said or them? The nin iccord graph ically continuously and in a few minutes just how wood rants during the long period of sensoning. The piece of red onk used in this movie was saturated.

teaches what is known as the fiber-saturation point, shrinkage begins. As the moisture knows the cell walls they shrink and draw the wood structure together.
The cell custiles, which were round at the beginning, become long and oval because the shrinkage of cak.

as of other woods, is considerably more tangentially

than radially
The film brings out strikingly the phenomenon of
the king A small cruck appears on the surface. It
rapidly lengthese and wishes until it seems as though
and a small counterly part. Then the crack the word would split completely apart. Then the crack aridually closes and finally becomes invisible.

Such crucks or checks however extend to only a

and trucks or there's mover extend to only a limited depth and are a common occurrence in sensor ing word. The outdoe surface which is exposed inturally dries faster than the inside. As the wood shrinks when it loses moleture, the outside tends to shink first I is inside is still moist and expanded to that the surface is held from shrinking. The stress shrink first that develops cracks the surface of the wood. As the

drying, even though the movement was only one ob-hundredth of an Inch, it shows the migroscope one of focus. He overcame this trouble by putting eight focus. He overcame this trouble by putting eight focus to be a superior of the state of the superior of the bands that held it in the proper position under the lean. The same area of the wood, shout a quarier of an inch in diameter, had to be kept under the neleconcey as the piece began to shrink, the was being photo-the increase. The same is a superior of the piece of wood and beneath it the wood shrank toward this pivot, and so traded to move into the expression throat of out of it, keep-ling the superior of the piece of wood and beneath to move into the expression throat of out of it, keep-ling the superior of the piece of the piece of Rangineers at the Furest Products Laboratory hope that this practical demonstration will be particularly

ingineers at the recent frounds Laboratory noge that this practical demonstration will be particularly lielpful to those who are using dry klins to season hunber. Various pictures can be made that will show clearly the harm done to the structure of wood by too rapid drying, poor circulation, and other ca



of x—biture hours of dyring changes the at reasons of a small red said back. In the first photograph the soil switten are about required they be switch through our in the second pulsaryons). In Pr. M. E. Dissers adjusted in the appearance presenting to taking motions plateurs of the shedward backed above the risk servy. Buth reasons are I light are operated autonomously at require intervals of ~Closesto risks of the red call blook both first or to the intervals of ~Closesto risks of the services and the said of the services are the best of the red call back both first or to the intervals or the service services to the back it such a A - clock is derived to the services to the services are the services of the services to the

Making the motion picture camera report the story of what happens to wood when it dries

with moisture at the beginning of the picture at the end of eighteen hours it was almost dry. As the mois ture evaporated the camera recorded the changes in the

surface of the red oak

One showing of this film would convince anyone that wood must be wasoned carefully before it is fit to use Pictures can be taken of each kind of useful wood. Pictures can be taken or each kind of useful wood, showing just what to expect when it masons. For instance a flet sawed red only board that is twelve inches while when it is green will be only cleven inches wide when it has sensoned er dried. The medion picture gives a clear idea of how and why this inevitable when he will be a set of the continuous distance.

shrinkage occur. The red ouk awd for the motion picture film was small about one has beginned and a quarter of an insh want in the changes could be noted by the change could be noted by the country rapix. It is Benerically to the changes of the noted by the changes of the noted by the changes of the noted by the changes of the changes of the changes of the secondary pictures of actions that can be sen only under the referencepe.

The beginning of the film shows the cross section of red oak as magnified that the cell structure is plainly as the country of the country of the film shows the cross section of red oak as magnified that the cell structure is plainly as the country of the country of the country of the country of the country from the cut country from the cut country from the country from the country from the cut country from the country from the country from the cut country from the cou

appear from the cell cavities as the wood dries.
When this free water has evaporated and the wood

a nature camera report me story of want shappens to what happens to the wood drive the strew is removed, the risks gradually close up and the wood appears mover actually level up to the wood appears now a cuttantly level up to the story of the story of

had to overcome many complications. In the first place, the light necessary for expansers produced so much heat that the wood dried too rapidly. It canebactment of the complex place is not strength of the complex place in the complex place in the complex place. The complex place is not designed to the complex place in the complex place in the complex place is not developed by these intermittent flashes was much lose than heat the light bound outliness, and the wood did not case-harden appreciably place in the complex place.

tices that are so common Presented with such vivid proofs of the harmoni effect of wrong practices, the woodworking industries may take more interest in blam ing scientific methods of 16m operation as a result of these novel "einemicrographia"

New Cadmium-Gallium Lamp

New Cadmirms-Gallium Lang.

"I'llis pooleries of light outcer from thick pare
I monochromatic light of variegs wave jumples and
pred lineasity may be obtained in from a practical
viewpoint of great importance in the field of sighter
viewpoint of great importance in the field of sighter
viewpoint of great importance in the field of sighter
allow of the control of t

HE word diabetes is derived from two Greek words, dia and beinein, which mean lit-erally to flow through. Diabetes is the

erally to flow through. Diabetes is the state of the certain matter which should remain in the human body, flows on therough the urfas. It has long been known as an incerable diseases, but recent developments have seemed arready frome, will be discovered in the bear future. These are two forms of diabetes. In one, which the physicians call diabetes melliture of glycouries, in other words engar efectases, an exceeders amount of sugar is found thereth. For our purpose we need not consider this form of the discouring the carefully discovered in the dispetitive trace of the body into a form of singus, known as glococer to the body into a form of singus, known as glococer and the state of the discount of the state of the body into a form of singus, known as glococer as an about or size it is stored in the liver for future use and best or size it is stored in the liver for future use and best or size it is stored in the liver for future use and best or size it is stored in the liver for future use. whenever we move our muscles, whether they are vol untary like those of the arms or legs, or involuntary like those of the heart and diaphragm (the muscle which performs the operation of filling and emptying which performs the operation of mining and employing the image), glucose is consumed, actually burnt up. It is easy to see that it is a serious matter when this substance cannot be burnt in the body and is excreted in the arine without performing its proper function in the body. This is what makes disbetes such a dread

Dishetes being a functional disease has been treated Diabetas being a functional disease has been treated mainly up to the present time by sirter regulation of the diet, so that it does not contain any sugar or starches. Diabetic prevans use exchants as a sweet-caing same in the piece of sugar Succhanton is a contain the contains and the starch starches and the starch starches are successful to the piece of sugar Succhanton in a contain the cities. It may be called a disease of civilization, as it is practically unknown among unce'ulized pooples. It is caused by too great a consumption of sugar, by own-eating, obseity, and by seedenfary life. It is found at all ages, occurs about twice as often is maise as in a contain the successful contains and the successful contains a successful contain people. The wide distribution of the disease and the apparent case with which people become afflicted with it and the practical impossibility of getting rid of it, once it is incurred, make the work that has been done within the part year to develop a remedy for diabetes of the greatest importance to every human being

Insulin. What It Is and What It Can Do It is about a year ago that a group of scientists in particular Drs. F. G. Banting and C. H. Best, working

The Attack Upon Diabetes

in the physiological laboratories of the University of Toronto, Canada, announced that they had discovered a preparation which possessed the marvelous property of lowering the sugar content of the blood of dogs, when it was injected into them by means of a hypowhen it was injected into them be means of a hypo-demic systine. This discovery was speech making in the history of medicine. The extract was made from the history of medicine. The extract was made from and the unborn cut? The process of making the ov-tract has been applied on a commercial scale and in this country there is at least one drug house of na-tional importance that is ready to supply insulin in require quantifies, under the name of litetia. The process of making the insulin extract is long and labor lous. It involves considerable time, as many extractions and purifications must be made before a product of the proper purity and strength can be obtained. The product must be standardized so that the dector will know just what quantity of the insulin to administer to his patient. The cost of the drug is explained by the intricacy of its manufacture

intricacy of its manufacture.

The drug evenies in the form of ampoules and must be administered hypederatically. When taken by the both of the property of the property of the blood Only the ordinary presentations when using the hypoderantic needle, need be followed when making the insulin interiods. The does are indered three times a day, a half hour before meals, during with small and the state of the against the same until the written of the english shows oversite the same until the arine of the patient shows no more sugar. Patients are easily taught how to use the needle themselves.

Insulin Not a (ure

The word cure, when applied to insulin must be used advisedly Insulin is not a permanent cure of diabetes. In fact certain forms of diabetes do not respond to it in fact certain forms of disbetes do not respond to it at all, and those partients who in benefited by it must keep on taking the drug constants. Othersise the original condition recurs. The effect of insulin is to reduce the sugar content of the blood and it renders the dishetic system capable of assumiting carbohydra uniteric reason capanic or neumitring carmon drates, that is, the sugars and starches. Even while taking the Insulin freatment the patient must be kept under a strict diet in which the relative proportions of car-bohydrates and fats are properly fixed.

Glucokinın

Glycogen is what is known as unimal starch. It is abundant in the green leaves of lettuce beans and wheat

and the bulb of the onion. It was found by another experimenter that these ma-terials contain a substance which helps the diabetic system, the system in which the pancress is not functioning properly to burn sugar. The new insulin is called glucokinin. It has been established that the pancreas takes the raw materials furnished by these foods and makes "insulin," that is, sugar burning substance, to suit itself

251

Another aid to sugar combustion is the substance culled intervin. This was developed in the laboratorie culled intervin. This was developed in the laboratorie culled intervin. This was developed in the laboratorie databath H McK. Intervirts is also a record, for disabeth experimental content of the laboratorie cultivation of the laboratori This substance has been used on diabetic patients with success. The fat, which is of white creamy color, odor-less and tasteless, is absorbed by the diabetic system to sees and more resp. is answered by the unifered system to about 30 per cent and seems to satisfy the hungry craying for fat that diabeties have. The results that have been obtained with this substance have been no promising that it hoped that diabetic patients of all kinds will be benefited by treatment with this medica ment. It must be emphasized that a choice between the several treatments here outlined can be made only by a physician - perhaps only by a specialist-after careful

Relief, Not Cure

In conclusion it must be emphasized again that these different medicaments are not absolute cures of dis-betes. When they are effective on the diabetic they e him to live a more normal existence and prev the development of complications which usually set in at some time or other in every diabetic sufferer. They make life more worth while living but they do not do make life more worth while living but they do not do away with the necessity of careful deting and hydrell living. The pathnt must take the medicament in-definitely, at least that is how the treatment appears today. Whether or not a permanent cure for dishelves will be worked out from further investigation and experiment along the same lines, only the future can tell. Severtheless the discovery of insulin and the other disbetes medicaments has given great impetus to further work along these lines to alleviate the sufferings of work along these lines to alleviate the sufferings of human beings from a disease, known at least for five centuries, but only within the past year actually rem-edied in any marked degree. And perhaps they point the way toward diseasers of an actual cure



ONSIDERABLE interest has

ONSIDERABLE interest has been manifested the past few weeks in the trial going on the Parkers of the Parkers of the Winnington, Delain to the Parkers of the Winnington, Delain to the Parkers of the Par claimed that the practice of the Germans was to give very few details of the actual manufacturing methods very few details of the actual manufacturing methods in the patents that they took out in this and other countries, with a view to hiding the secrets of the manufacturing processes, only the essential principles of the various processes were described, and it has been generally held that it is impossible to prepare many of the complex chemicals, drum, dres and perfumes from the information that can be gleaned from the patent

the complex chemicals, drum, dyes and perfumes rroin the information that can be pleumed from the patent in the information that can be pleumed from the patent. Octable experience has demonstrated the truth of this distancent. Bany German parents, which have been read by the writer, contain but very little information of practical values, which can be used in numbrically the satisfies forming the subject of the patient While the static forming the subject of the patient while he stated in the parent of the parent which are not in any way described in the actual operation of a manufacturing process, in the actual operation of the precess difficulties are always encountered which are not in any way described in the patient and while he way to be the precess and so the first parents of the precess and so the devails which are described in the specifications.

The Court, in order to decide the value of the patient of chichophen, ordered a chemist to make a test of the same by carrying out the instructions given therein calcing the control of the patient; the value of the patient; the way considered best to have an actual

Chemistry by Court Order

experimental test made, which it was hoped would settle the question conclusively The experiment was made by Dr Freedman in the The experiment was made by 1rr Freeman in the laboratory of Swarthmore University at Swarthmore Pa, and was closely watched by experts and deputy marshals. It lasted 2015 home without miserruption Cinchephen was produced in the experiment, but, as the experimenter himself stated in an unmarkitable state. Two experiments in all serv made and in ord them the experimenter made a whigh definition from or them the experimenter was a significant of the production of the state of the stat the instructions given in the patent in pouring in two constituents, one after the other instead of simultane-ously, but rapidly enough so that their action was actically simultaneous. In the first experiment the eld was 29 6 per cent of the theoretical but the prod uct was too impure to be of any commercial value. It is possible to purify the mass so as to obtain a higher grade product. However the yield is too small It is possible to purify the maw so us to obtain a higher grade product. However the yield is too small to make the process of any commercial value. In the second experiment the yield was 143 per cent of higher grade product. A large amount of tarry matter was obtained which it was elabated could be purified to an extent permitting a larger yield and the refore nearer to

The sum total of the test seemed to be that the in formation contained in the patent was sufficient for preparing enchophen, but the product obtained was not commercially feasible because of the small yield A large nums of tarry matters were also obtained from A large nums of tarry matters were also obtained from which it may be possible to preyam more dischaplane, which it may be possible to preyam more dischaplane, etc. Here sagain it appears as if the real secret of the process has been hidden, that the particular detail which is crucial in determining the practical details and the process, but a commercial product can only be obtained when the residues are worked up so that a satisfactory yield the residues are worked up so that a satisfactory yield

is secured. This is typical of most German patents, for in their patents, particu hith the chemical patents, the Germans were not eager to give any information of value to competitors, or possible competitors, while they were us enough to secure putent protec

The Lowest Temperature Yet Reached

THE Bureau of Standards Washington, D. C., re-cently announced that the nearest approach to the absolute zero temperature which has yet been attained absolute zero temperature which has yet been attained has been recently achieved by Professor It Kamerlingh Omnes, of the University of Leyden Holland. The rec-ord temperature of 27218 below zero (entigrade, or, as the physicisty express it .82 degrees absolute, was as the physicists express it. 32 degrees absolute, was reached by the Just ha sheath in an unsuccessful at-tempt to solidify liquid belium. The temperature is belief at this temperature the liquid belium showed absolutely no tendenty to solidify according to the report of Dr. Onnes, who expresses the opinion that helium may remain a liquid even at the absolute zero. This temperature, 271 degrees below zero testigrator, denotes the entire absence of heat, or, expressed in more scientific language, the entire absence of atomic of decuber motom

Every gas has been both liquefled and solidified ex-Every, gas has been both liquided and solidified expl billing with his nacrot been reduced to the solid state in spite of years of effort. De finase in his most perfect with a spite of years of effort. De finase in his most perfect vucuum attainable the pressure at the surface of the liquid being only thirteen thousandli so attained to the surface of the liquid being only thirteen thousandle of an utilization of mercury, or about one shall be thousandly and a millimeter of mercury, or about one shall be the surface of the liquid being vacuum pumps connected in grantel was used to obtain this evenit! The previous attempts to solidify bellinn having produced a tempera attempts to solidify bellinn having produced a tempera liquid attempt of the surface of the surf latest attempt with the utmost refinement of technique and he was successful in getting the lowest temperature ever produced by man.

Reaching Upward With Concrete How the Twelve-Story Limit Set on Concrete Build-

ings Has Been Discarded by Enterprising Architects

By Norman M Stineman

ACE in 1902 work was started on a sixteen story reinforced concrete office building in Cincinnut, known as the Inguis Building This was the biggest single step in re-inforced concrete construction up to that time. To some it may seem strange that id structural engineers did not follow up

archite is and structural engineers (ii) not follow up the precedent cetablished by this unusual building, but continued to design tall buildings by older nothous Lack of knowledge as to how to design this new mute-rial, reinforced concrete, naturally was at the bottom of the whole thing. It was much less embarrassing to an architect to argue his client away from reinforced concrete than to admit that he did not know how to deal with it in the design of a large building

By 1908 the theory of the design of reinforced concrete structures had become quite well established but in the meantime an erroncous idea concerning the practicable height ings became well rosted. It was said that a height of twelve stories was about the economic limit, be-cause in higher structures the lowerstory columns would be very large and would occupy too much valu tect or structural engineer or writer tect or structural engineer or writer out of a hundred who made this statement had actually tested out its truth or faistly by independent investigations of his own But, at any rate, no more Ingalls buildings ppeared for many years to follow It was not until the prohibitive

war prices of structural steel made the use of other materials impera tive that designers of tall buildings again turned to reinforced concrete

structural frames. They seen dis for the columns in the lower stories, such as 1 1 2 or 1 1½ 3, and reinforcing the columns with both vertical steel bars and spiral steel hosping they could design reinforced control columns that were no birger and in some instances not as large, as e

steel columns in the same position One of the most conspicuous results of these later investigations is the Arcade Building in 8t Louis, a reinforced concrete office building having sevente stories above the sidewalk and two stories below. This structure, completed in 1917, greatly stimulated the interest of builders in the possibilities of reinforced con erate for very tall structures, so that the Arcade Build ing did not long hold its record as the tallest reinforced

oncrete building in the world.

If was superseded in 1921 by the Hide and Leather Building in New York City, an eighteen-story office building having not only a reinforced concrete struc-tural frame, but also an exterior

facing of a special mixture of con Not to be outdone, Dallas, Texas, e forward with a nineteen story came torward with a universal story reinforced concrete office building known as the Medleni Arts Building completed very early in 1923. It has supplanted the Hide and Leather Building as the tallest re-inforced concrete building in exis-

And now comes a story from Day ton, Ohio, to the effect that the new twenty-one-story addition to the twenty-one-story addition to the U B Building in that dry will have a reinforced concrete structural frame, from which it appears that Dullas will enjoy its present dis-tinction for a limited time out. The Dayton structure, for which the con-Dayton structure, for which the con tract was awarded early in 1923, will have a ground area of '90 by 129 feet for the first fifteen stories, while the upper six stories will be fifty

feet square. It will be 276 feet high from the first floor level to the top of the building. It will involve no outstanding problems of design, that it will mark a permanent limit to the height of buildings of this sort,

The Fact, the Course, and the Causes of Organic Evolution W in may distinguish between V(1) the fact of evolution, as representing the historical series of events, (2) the course followed in evolution, for instance, whether the land vertebrates arose from tish like ancestors, birds from reptiles, or the



Arcade Building, St. Louis: 17 stories, completed in 1917

eted in 1917 sent the most difficult problem of all and the one regarding which we know the least. The recent stric-tures of Professor Bateson, which tionists, were directed wholly at our rent explanations of evolutionary causation and the course of evolucausation and the course of evolu-tion. He affirmed his belief in the historic fact when he said. "Our faith in evolution is unshaken"— meaning by "faith," of course, a rea-

onable belief resting upon evide With this distinction between fact course and causes clearly in mind, the significance of Darwin's work in the history of biological thought can be understood. Dar win's accomplishment was two-fold

In the first place, he established organic evolution as the only reasonable ex-





Ingalis Building, Cincinnati: 16

like, and (3) the causes of evolution or what made and makes it

tion or what made and makes it happen. These three aspects, like those in the voyage of a ship, are separate through related items. They must be constantly distinguished, if

there is to be any clear thinking on this matter. The historical fact of

evolution means attested by over whelming evidence Science has nothing to conceal, it stands "strong in the strength of demonstrable

facts," and invites you to view the evidence The course pursued by evolution is known broadly in many

instances, but in the nature of the

many of the steps will always re-main uncertain, without, however,

calling in question of the historic fact The causes

of evolution pre-

evidence is limited, and

ational and experimental The total result was over

whelming.

The importance of Darwin's work in the history of scientific thought is that it convinced acience of the truth of organic evolution and proposed a then plausible theory of evolutionary causation. Since Darwin's time, evolution as the historic fact has received confirmation on every hand. It is now regarded by tional explanation of an overv tional explanation of an overwhelm ing mass of facts. Its strength lies in the extent to which it gives mean ing to so many phenomena that would be meaningless without such an hypothesis. But the case of nat an hypothesis. But the case of har ural selection is far different. Of recent years, this theory of the causes of evolution has suffered a decline No further hypothesis.

Cincinnatii 16 decilies No further hypothesis detect in 1988 in the competent of the property of the present part of the competent of the present part of the uniform the most attention of the uniform the most account of the competence of the present of the theory of the competence of the problem, blokelysts have often seems of the problem, blokelysts have often seemed to condemn overhilds in the competence of the problem, blokelysts have often seemed to condemn overhilds in the competence of the problem, blokelysts have often seemed to condemn overhilds in the competence of the problem, blokelysts have often seemed to condemn the competence of the problem, blokelysts have often seemed to condemn the competence of the problem, blokelysts have often seemed to condemn the competence of the problem, blokelysts have often seemed the condemn the competence of the problem, blokelysts of the problem, blokel that belief in Durwhiam is on the wan. He does not understand that what is thus meant by Darwhiam is not the historic fact of evolution, but the proposed cause of evolution—natural selection—betweet from article by W C Utris of the University of Missouri, is Bohool and Society for her! and Society for Upril 14, 1925

Germany Builds New Super Radio Station

AFTER the completion of the new wireless station, which the C Lorenz Company is now constructing in the I peer Buvarian Alps, Germany will have the most powerful and best equipped radio central in the world. At first it will be devoted to

world At first it will be devoted to experiments on a large scale, but later it will be operated by the C Lorens Company, under a charter by the government, for commercial and governmental purposes. One of the remarkable features of

One of the remarkable features of the new super radio staticus, which is located in a shallow valley have tween the Herzogstand (1732 m) and the Stein, one of the foot hills which rises above the Korhel Lake to a height of 540 m, is the manner in with the suntamas are phosed From the top of the Stein Bro serial color than the state of the stein of the state of the st are stretched in tan manon to ave anchor points at the top of the Her-sopstand, at an average height of 300 m above the station building. The combined length of the five

The combined rength of the new cables is about 2½ km. To prevent excessive strain on the aerials by wind or sleet, the insulated ends of the antennee are attached to a powr Building. New the antennee are attached to a possible which pusses over a pulley at the highest point of the cable a heavily weighted car is fustened, which rests cable a heavily weighted car is fustened, which rests on an inclined track on the further alope of the hill The ballant on the car is sufficiently heavy to keep the five acrisis well stretched under normal conditions and to counterbuliance their weight when they are exposed

to strong wind or are coated with ice. In this way it is hoped that sagging of the antenns will at all times be kept within permissible limits. kept within permissible limits.
For anding out electro-magnetic warse two units will be provided, a Poulsen-Lorent a relight neader of a proximately 2000 key and a blair-frequency generator of the Schmidt type of equal capacity. The electrical context of the second will be obtained by the provided will be a second with the provided will be obtained of the first first, and the provided will be obtained either directly from the generator will be obtained either directly from the generator of a frequency transformer as at Nauma. As the optimised will reader it possible to make, for the first time, a comparative text of the two methods of sending, the result of the contampliant deats is availed with great interest by radio experts an all parts availed with great interest by radio experts an all parts



Hide and Leather Building, New York: 18 stories; completed in 1921

Medical Arts Building, Dallas; 19

Waterproofing Cloth by Electrical and Chemical Action

Chemical Action

ORIGINALIX there were two general methods of rendering fabries resistant to water. The machanical process of impregnating the cloth with rubber, resista, wazzes or gums makes the fabric are non-resistant, wazzes or gums makes the fabric are non-resistant whereas in most applications air circulation through them is essential. Chemical impregnation of the debt with a continuit which is insulised in water, while meeting this difficulty, is open to the objection that all such coatings known are insoluble only up to

a certain point, and will a certain point, and win quickly disuppear on vigor-ous washing such as is or-dinarily conducted in the household and the laundry, while such fabrics cannot be dry-cleaned, the aluminum soap which constitutes the waterproof coating, being soluble in the bearene of the dry-cleaner's soap.

Numerous efforts had be

made to avoid both horns of this dilemma by the devel waterproofing process of some sort, but none of these processes had reached a com-mercial development. In 1907 this phase of the subject d O Tate, a Rhode Island manufacturer Mr Tate had been private secre-tary to Edison in the early eightles, at a time when the dean of inventors was working with a telephone receiver consisting of a chalk cylin-

dee moistened with a chemical solution and revolved ter, monotone with a centeria souther and reverses, by a motor. Under the variations of the incoming cur-rent the electro-essentic properties of this cylinder un-derwent local variations, and it was possible to utilize derwest local variations, and it was possible to utilize these variations in reproducing the wound which had been impressed upon the current at the sending end. The device, however, was much too complicated for extensive development, and was replaced in due time, extensive development, and was replaced in due time, by the present receiver It is, deservedly, the least well known of Mr Edison's inventions but it is of interest on its own grounds. In particular, Mr Tate's recollection of the work done with it brought him to realize that the principle involved in the waterp

of fabrics, not merely by couting them with a the surface, but by causing the water-repellant agents to penetrate into the very internal struc-ture of the fibers themselves, was one of elec-tro-osmosis, just as in the case of the chalk shome receiver

of Mr Tute's first waterproofing machine, devel-oped in 1908, have been retained in all the sub ent improved models. There is the graph ite electrode, the cathode over which a solution of aluminum acetate is permitted to flow, an aluminum anodo, and a heavy woolen pad com-pletely enveloping the latter—a distinctive characteristic of the in-

vention, making it pos-sible to attain an evenly distributed waterproofing sible to attain an eventy distributed waterproofing. Laid saids for neveral years, the lides was picked up again after the outbreak of the war, and a second and third machine produced in 1015 and 1016. The latter was installed in Mostreel in October 1016, and outside uniform. The control of the control of

abandoned for the plate. This change led to the pretype of machine, in successful commercial use today type of machine, in successful commercial use today at the Tate plant in Cranston, R I This plant has a waterproofing capacity of about 36,000,000 yards per

Wool and silk fabrics are waterproofed on a machine with two acts of electrodes, cotton fabrics on one with four sets. The extra electrodes are necessitated by the structure of the cotton fiber, less easily penetrated by the chemicals than the wool or silk. The cloth passes first through a bath of sodium cleate, a very dilute solution being used. The fabra dust into the



Electrolytic waterproofing and converting machine of the plate type which waterproofs fabrics of various kinds

both in an andless hand, the every wolution being both in an endless band, the everses solution being squeezed out as it passes between hard rubber rolls. The treatment is repeated, when the total is ready for the electrodes. So far as the chemicals used in this and later steps are concerned, the process is identical with the unsatisfactory ones which it is intended to supersede, the difference lies in the more thorough pencirction of the material under the electroly its action

than under ordinary physical contact.

The electrodes are arranged vertically. The anode is built of aluminum bars, one above another and builted together in a suitable frame, over which the woolen pad mentioned above is secured. The cathode is also passes from the graphite cathode through the cloth to the positive aluminum electrode

The essential feature is the simplicity and the case with which the treatment of the cloth is effected. The cloth takes but little time to pass through the machine, and it is really remarkable to observe how muc properties are changed by this short treatment properties are changed by this short treatment. An ordinary piece of printed calles, which absorbs water like a spange before treatment, sheds it like the back of a duck after treatment. Under ordinary pressure the water will absolutely not penetrate into the fibers. (Continued on page 290)

An Air Washer for the

Automobile

In any engine, no matter
what the service in which
it is used, the chief cause of wear of pistons, rings and drawn in with the air supply Furthermore, such dust in almost all cases comprises well over half of the solid matter or "carbon deposit" that accumulates in the com-

Practically complete re-moval of dust from the air is accomplished by sim means and in small space in the novel air washer sho herewith, in which the air and become thoroughly mixed with a fine water spray During this mixing the water gets presented of the dust, and retains it After the water spray treatment, all liquid water is re-

meet, all liquid water is re-moved from the air, and the inther passes on to the eagine thereughly cleaned and somewhat bundliffled. Tests show channing diluseries never less than if Tests show channing diluseries never less than if is increased the cleaning efficiency always increases. In anking such tests only the finest and most insuplable dust obtainable has been employed so it is claimed. Steep sage is finalized with the grade and most insuplable for the steep of the steep of the steep of the steep than the steep of the steep of the steep of the steep in get and great results from the special steep of the in gets and great results from the special steep of the special steep of the steep of the steep of the steep currier in the steep Use of the results of the steep currier in the steep Use of the results continuously in

results continuously in just such a condition of the air—somewhat lower temperatures and humidity

In the case of an en-gine that "pinks" read-ily, it is a certainty that of the air washer will climinate the pinking and will, therefor couse an increase in the

power delivery To insure a clean air supply, having a considerable amount of water vapor in it, it is only necessury to keep the washer supplied with water The one and onequarter-inch washes (suitable for use with all engines having one inch or one and one-quarter-inch carbureters) has a water supply capacity of one gallon, which supply is suffi



vertical, and consists of graphite bars, fitted loosely into metal guides and held in position by springs, which allow a delicate regulation of the pressure against the cloth as it moves through the mathine. This makes it possible to vary the pressure according to the char-neter of the fabric being treated, and to pass a seam through the machine without stopping the apparatus. tending the width of the bar and perforated at the bottom with small openings. The solution of aluminum acetate is fed to these troughs continually and trickles down through the perforations, wetting the cloth thor-oughly and making it a conductor of the current, which cient for from 500 to 1000 miles of running The high cleaning efficiency of the automobile air waster is the result of the very intimute contact bewaster is the result of the very infinite contact be-tween the water and the nir, and is somewhat con-tributed to by the fact that none of the dirty water passes out of the waster with the nir. The finely sprayed water is completely separated from the air, after it takes on the dust, and for this reason the rates of water consumption are very low and are wholly accounted for by the evaporation. At the same time, accumulation of diri in the washer has no effect upon the cleaning efficiency, nor does it cause the slightest se in the pressure drop through the wash

Make-Believe Lightning

Investigating Lightning Voltages in the Laboratory to Solve Lightning Arrester Problems

By F W Peek, Jr. General Electric High-Voltage Engineering Laboratory



Sixty-cycle are caused by the flashing over of high-

STUDYING the effects of lightning on transmission lines and on such apparatus as transformers and lightning arresters, it is important to have facilities for producing lightning voltages in the laboratory closely

approximating those occurring in practice gation of the lightning voltages induced assulssion lines has shown that during any storm on transmission lines has shown that during any storm many disk harges take place on gap set for lower volt-tages. The discharges become less and less frequent for the higher settings, and finally very few are found that exceed about 400 K V, or 400,000 volts. However, higher voltages do occur occasionally. Another check on the voltage is the fact that insulator strings of seven or eight units rarely flash over during lightning storms. or eight units rarcy has over during incoming storms. Lighthing voltages or inquities are known to be of very steep wave front, which has the effect of increasing the voltages across an insuitator or other gaparatus at the rate of millions of volts per second. A few years ago a 200-KV or 250 004-volt impulse or lighthing generator was built to give lighting or lighting generator was built to give lighting unlarged of prederentiand climate itselfs. The link ing

rounges or preferentiates cuarticitatics. The link lag of various gaps was carefully measured and the term "impulse ratio" resulted. This generator has been added to from time to time as higher extitus voltages have become available. As in reuse to atmost 750 KV or 750,000 rots was made in 1016, while within the last year an increase to approximately two mill wolts has been made

It is not the intention to give details of the apparatus

It is not the intention to give certain or the ap-here since these data may be obtained from technical reports now available. Briefly, the voltage is obtained by charging a large con-denser to the desired voltage and discharging if through a known inductance and resistance. Standard step-up transformers are used in sufficient number to obtain the desired voltage for charging the condensers. The result is a

for therefore the conformers. The result is a single lightning impulse of great power. In the lightning tests dowerbed in the lightning tests dowerbed in the 'ballion million of the great control of the control of all of million million of the property of the control of the waits. The time of application is measured with the lightness of the control of the waits the time of application is measured with the lightness of the control of the

a loud sharp report or crack

Its means of the high voltages obtainable in the General Electric High Voltage Engineerin the teneral Eccuric, high voltage Engineer-ing Laborators at Pittsfield Mass, it has been possible to learn much regarding high tension insulators. One of the problems that has been solved is whether lightning voltages will clear a whielded insulator string, just as will a 60-cycle spark-over. Heretofora, impalso rollages officiently high to spark over a string have not need available, our parographs made or the tests indicate that the inquise goes to the shield and clears the atring. These tests are conducted in the dark, so that the camera may record the results. The photographs show

the sparks that last less than a millionth of a second Other test have show how resulty a lightning spark of the state of the sparks of the spark of the sparks of the sparks of the spark of the sparks of the spar phases of the work has been the simulation of actual lightning striking a miniature church and houses, as shown in one of the accompanying

The High Voltage Engineering Lab-oratory at Pittsfield is equipped with the apparatus necessary carry on the problems of pure and applied research, as well as the appned researce, as more immediate developmental prob-lems. The first essential of such a laboratory is plenty of free spa a single example will make this apparent During a recent investigation sparks over eighteen feet in length were obtained A visitor's gallery is provided so that the sparks may be observed in safety It is possible to make this whole

laboratory dark in a few minutes. A smaller dark room is available for tests up to 300 K.V or 300,000 volts. The whole building is of anabeatania brick construction and heart at practically constaint isemperature inside Apparatus is available state inside Apparatus is available weather conditions as heat and cold, and rain and down formation on inministors. Special measuring instruments are also available. As an example, apheres forly inches in diameter are heressary to measure the very high voltages.



eneral view of the imitation-lightning producing apparatus employe in the High-Voltage Engineering Laboratory at Pittsfield. Mann.

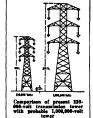


Miniature church and cottage struck by man-made lightning bolts

just what are the possible uses of a million volts in practical transmission. The conductor for such high voltage would be about one-half inch in diameter. It it is assumed that this is a hollow tube with copper equivalent to a one-line hor d, it is possible to transmit 3,000,000 kilowatts a thousand miles with about 12 per 3,000,000 kilowatts a thousand miles with about 12 per cent loss and a million volte at each end. If fire-inch tubes were used there would be very little loss in fair weather, but during a rainstorm the loss would be of the order of 1000 kilowatts per mile. An approximate 1000 kilowatts per mile. An approximate volte of the size of a 1000-KV or 1,000,000-volt tower, compared with a 200-KV tower, is given in the accom-

panying sketch.

The striking fact that these figures bring out is the large amount of power necessary to make such a line ecunomically desirable. They also emphasise the enormous size of the apparatus units necessary. If present practice were followed, 1,000,000-kilowatt transformer units 1,000,000-kilowatt transformer units would be necessary This would probably mean execting them in the field. The problem of size and transportation becomes greater than the problem of voltage. However, it is only a little over ten years ago that the 220-KV thee was in a similar laboratory stage as the 1,000,000-will lime discussed today.



UMANTON TO THE MENT OF THE MEN

statement is to the effect that aluminum, sheets or plates are being used for stage scenery by the managing diverse of the upera house in that city. It is also stated to the contract of the

crations which are put on can easily be arrand and no account cidifications have yet appeared through the use of the new material. The many control of the c

Radio Without Interference

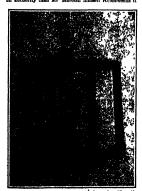
Experiments Proving that Radio Messages May be Sent Successfully on Wave Length of Ten Meters

By D H. George

OWN at the Cleveland Park inhoratories of the Department of Commerces in the 11st Cert of Columbia, latterly if was channed to puse that war you could have seven to puse that war you could have seven to be compared to the control of the control o

ngths of ten meters were in progress
Had you been interested and inquired further about the novel apparatus—such as you probably had never seen before—the Federal investigators would have told you it was a parabolic reflector that was being used in the speck-making experiments that have paved the way

the speck-making experiments that have paved in, was for taking the feur out of interference—the heretofore unconquerable bugaboo of radio communication Briefly, the national search and rewatch has devel oped the bronciad facts that interference between differ oped the froncisis racts that interference between differ-ent radio transmitting stations can be reduced by the use of markedly directional antenna for transmitting and receiving, and by the use of short wave lengths not at present employed. These data are of inestinable selectific importance despite that they demonstrate that directional antenne are not suitable for bread sating market reports, music or other form of entertainment However, they can be employed successfully for the reception of such material that is circulated via wireless For point to point communications—uncoming a sent directly from a certain transmitting station to a definite receiving station—directional antenne can be employed advantageously at both outspills, and incoming ends It is an abrupt departure from the fundamental receives of realizable precision of realizable precisions of realizable precisions of realizable precisions, realizable precisions are the state of the receiver to who lengths from others than 20 meters. To violate precedent and to attempt to harrows very five department of the realizable precision of the realizable precisi receiving station—directional untenna can be employed



ion-motor transmitter, consisting of a 56-watt on tabe, the elements of which are used as the detect, and a simple coupling arrangement

Albeit the national authorities down Washington was here interly acted on the Magnetions of the inventor of which was the result being a wisk of experiments of which was the result being a wisk of experiments of the state of t were used to radiate the ways from the generating set. A special coupling coil was link d between the two A special coupling our way and a necessary the two vertical conductors and the guitating set thus was coupled to the system. The generating set with the vertical conductors was suspen fed in the found axis of the parabolic cylinder. Inch wire of the reflectin was tuned separately to ten meters by adjusting its length With all adjustments of the reflector correctly made satisfactory directional transmission was obtained. The



Forty wires, each 14 feet 5 inches long, spaced one foot apart in the parabolic reflector for maximum reflection on a ten-meter wave length tests demonstrated that at least 7) per cent of the radi-

treats demonstrated that at level 7: pri cant of the radial power was confined to an ongoi of 40 degrees and power was confined to an ongoi of 40 degrees be the use of the parabolic reflect r and the short was been to the search of the state of the sta

—occasionally during the minimar season these strays become so bad as to render whichese communication impossible — were practically clinimated where such short wave lengths as ten meters were used. The small directional antenna used in explanation with the wave

directional anceans used in commercial with the water that the content market reduce the difficulties that enumeric market reduce the difficulties that enumer from illustrate straws. Furthermore, some of the most recent assume of point to point to point to ourseasterious such as the sendings of point to point to point communication such as the sendings of point to point to point to ourseasteries and the results of the sendings be carried on and improved in the directive short was transmission. I ediween points in otherwise readili-ne condition relative to the relative readili-ne condition directive transmission makes possible care in addition directive transmission makes possible care in addition directive transmission makes possible care in-difficult of the condition of the condition of the con-cept of the condition of the condition of the con-cept of the condition of the condition of the powerful governing set in required to core a certain distance than with a mealine the uniterna ment trop-was used in the recent Frederil tests because it func-



Receiving apparatus employed by Government exradiation from parabolic reflector

tioned at higher frequencies than any of the others tried out. As the most effective method of obtaining directive transmissi n for short wave lengths was by directive transmissed in fer where wave lengths was by the use-of a relictor in the form of a partibility (alliades this wave the system followed. The wave from this works; of solid relictors is quite solid into a partial beam works; of the relictor is a solid relictor of the relictor series. This takes is was much be suspending. Of where from a frame corrective of in the form of a pure both I ach of the where was tunned to be meetrs and spaced on ford in 11. The frame was hung from a cross stretched between two poles with the relieved of could remain through Med dature. The suspended where Could rotate through 800 degrees. The suspended wires were insulated from the frame and from each other the focal distance was made one-quarter of a wave length 2.5 metric or 184 inches. The reflector was made like a purabolic celluder because this form main tains the priper place relations and obtains maximum

lefaction

To receiving signals at distances greater than 170
teet a receiving st made up of a detect r and two
staces of audio frequency a pilication was used. An
external heterodyne was employed when receiving conexternal httreshine was employed when receiving com-line us was eigened. The antenna used in picking up the energy at the receiving apparatus was a single wire tunnel to the line ming, wast frequency and coughed at its emiter by means of a special of 16 other secondary cold of the receiving set. The tetal length of the wire-used in this antenna was 14 for 4 linelses. Reference in all cases were injuried; where the

lengths of the reflecting wires were not the same the reflecting wires were all made the same length and the wave length of the signal source was made slightly shorter than ten meters the reflecting wires were thrown out of tune and the radiation the of the reflector was equal to one half that along the true line of reflection. The best possible reflection was obtained when the length of each of the 40 reflecting water was made 14 feet 5 inches and these wires were specific in the aput. All them data were obtained special, in hes apart. All these data were obtained with the rich tor hunding an aperture equal to one wave length. The aperture was then increased to 15 wave lengths the parabelle frame being extended with ten immelysires suspended one food apart on each exton immediates superiord one root apart on each ex-tend in This art incomit resulted in no leakage at the rint of the telect 1. Very poor reflection necom-panied by cudderable hadage obtained when every other whre was rint ord and the total was reduced from 40 (1) 20. This resulted because the remaining when were detuned by the remeable of their neighbors.

To determine the effect of taking through a hole in the parab la ten consecutive reflecting wires were removed with the consequence that he is leakage oc-curred. These tests showed that for efficient direction transmission the source of the waves to be reflected must be placed exactly at the fixus the reflecting wires must be funed to resonance with the source while the width of the reflected wave front is dependent on the size of the speriors empleyed Strong signals we received at a distance of two miles using a single-tucoil antenna six inches in diameter

12



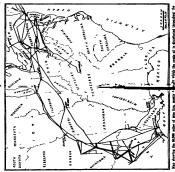
In 1922 the United States prediced over 23 billion gallons of crude oil, 62 per cent

that of this branch is castic stated. The thinsel states produces about 10 per cent of the works supply of crade perceiver. There are in present neer than 2010th per-bollette will be take centry and the 1025 colout was Thatmood terrais of 4.2 gallets cash.

the control of the co

How 23 Billion Gallons of Cerde Oil Annually are Piped, Refined and Distributed to the Consumer The Story of Oil

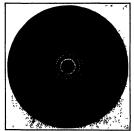
whereing the external regions provided by Communication to the control of the con



Measuring with Light Waves

How the Various Wave-Lengths are Made to Serve as Scales

By W F Meggers, Ph. D



Interference fringes produced by passing monochromatic light through an interferometer

THESE times when the other is throb bing with radio waves everyone has acquired increased interest in and under standing of electromagnetic phenomena It has required nearly a century to show that yields Il, it heat energy or infra-red light, ultra violet Il, it, therifall waves used in "wireless, and finally X rays and the gamma waves arising from radio active materials, are all similar cles tromagnetic wave motions in the other, and are dis-tinguished only by a difference in wave-length. Althese wave motions represent transfers of energy and they are propagated in free space with the same veloc about 300 000 kilometers or 186,000 miles per se

and These waves can be toughned to originate in country of the country of continuous and the continuous of the country of continuous and a fundamental constant of the particular vibrating coston. It is evident that when this frequency (number of vibrations per second) is multiplied by the wave-length (distance between create of adhernt waves) we obtain the velocity or linear distance traversed by a wave in unit time The entire range of wave-brights with which science has become familiar extends from thousands of meters

(1 mater - 20 t7 inches) for water mad in radio com-

number from to about one bundred billionth of a meter (0.0000000000 d inch) for the shortest Nances. In terms of frequencies this range extends from a few and vibrations per sec ond for wireless waves to 90 guintillions (3 followed by 19 (lphers) for the short est among \ waves enormous range of wave-lengths the waves of ordi-nary light comprise a rela fively small portion (from 4 to 8 ten millionths of a meter or 16 to 32 hundred thou andths of an inch! but this is the only portion for which nature has specifically en dowed us with organs to

White light is a mixture of many different colors each of which represents light waves of definite length When white light is dispersed and resolved into its component colors, as hap-pens in the rainbow or in certain optical devices (prism or diffraction grating spec-troscopes), a continuous spectrum — a natural scale of colors—is formed in which

different waves (colors) are arranged in order of their length, the violet representing the shortest, the red the longest ones visible. All incandescent solid substances (the sun, the electric lamp filament, the luminous gas flame) emit such a continuous spectrum Elementary substances, however when made luminous in flames, cleatrical arcs or sparks in general do not emit con clearfield area or sparies in general do not eithit con-tinuous spectra, but when theven with a spectrus-upe show bright colored lines on a dark background, each result of the spectrus of the spectrus of the spectrus in an are between two pieces of pure iron, some of the iron is avaparised and entaits a spectrum condusting of more than 4900 lines, and waves of other length in than these are absent from the train of energy given off by this element. The number of lines and their spectral distribution is different for different elements. but each chemical element when properly excited to omit a spectrum shows bright colored lines whose absolute wave-lengths and relative intensities are charac-teristic of that element alone. This fact is the basis of spectrochemical analysis the presence of a particu-lar chemical element is positively established if one or

air cuentai verment in positively estamismed it one or more of its spectral lines are identified. Now it might be assumed that each spectral line represents one and only one wave-length but this is not the case, the lines actually inverfailte "width" and represent an extremely short stretch of spectrum. The average width of a line from the iron are, for example, is 60 trillionths of a meter, while that of the red line from cadmium is about one-tenth as great A very narrow line is almost ideally monochromatic and per-mits a more accurate measurement of wave-length than a broad line. This finite width of spectral lines is principally due to the thermal agitation of the molecules or atoms in which the radiation has its origin which by a curious coincidence, was chosen by Pro-fessor Russell as the subject of his monthly talk for

this issue (See page 264)
In 1864 Fizeur a famous French physicist stated that "a ray of light with its scries of undulations of that "a ray of light with its wries of undulations of extreme fineness but privily regular, may be con-sidered as a natural micrometer of the greatest perfec-tion, perfectly suited to determine lengths." Nearly 10 years later Professor Michelson, the American physicist, went to the international Bureau of Weights a went to the intermitman intreduct weights and assures in air Paris and determined what number of wavelengths of red, given and blue light emitted by luminous columbar upor equaled the standard meter, which had been established 100 years earlier with the intention neen extanished 100 years earner with the intention that it should represent one do-nillilanth of the earth a circumference. This experiment was repeated in a slightly different way in 1007 by French scientists and the results which they obtained agreed with those obthe results which they obtained agreed with those called by Michelson to one part in sixteen millions



The same are planed on a free plane, and a second two plane and a local on ten. Monoversell light by gased whose the super above to grane and interference fringes arise from reduction from the lower surface of the glass and the tops of it metal gages. These fringes sive information not only on the relative lengths of the gages but also indicate serves in finite and parallelism of the end surfaces. More details of the proper but also indicate serves in finite and parallelism of the end surfaces. More details of the property of the proper

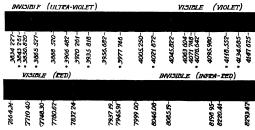
Comparison of gages by means of light waves

The wave-lengths of several hundred other spectral lines have been compared with that of the ca red line and these are called secondary standards. They comprise selected sharp lines from various light sources such as the iron arc or spectrum tubes con taining rare gases, and are fairly well distributed taining rare gases, and are rairy well distributed throughout the spectrum from ultra violet to red, so that they may serve as reference standards for the measurement of other wave-lengths and for length measurements in general. The probable error in these standards does not exceed one part in five million and in many cuses it is even less. Such results are actually obtained by the use of suitable optical apparatus called the 'interferometer,' in which the physical principle involved is the same as that which explains the beauti-ful colors observed in thin films of oil on water, namely, the interference between waves reflected from two parthe interference between waves reflected from two par-niled or nearly parallel suffaces. If it were possible to neasure with the same accuracy a distance of ten niles, it would mean that this length could be deter-nined correctly to within one-cighth of an inch In recent years the Bureau of Standards has carried

on extensive investigations with the interferometer to
perfect a system of suitable

F (VIOLET) standard wave-lengths and to develop the application of to develop the application of these to precise measure-ments of length. This lab-oratory has compared the wave-lengths of more than 500 Iron lines with the pri-mary standard, 20 lines in the spectrum of helium, 55 in neon, 50 in argon, 18 in krypton, 12 in xenon, and 12 in cadmium

All light waves have their All light waves have their true fundamental length only in a vacuum in ordinary air like that in which we live and make measurements, the visible light waves are slightly decreased in length (by about one part in 2600). The ratio of a wave-length of the control of the control of the ordinary ordinal sequel to the ex-called index of retra-ction of the six and this the so-called index of retrac-tion of the air and this varies throughout the spec-trum and according to the density of the air as detarined by its pressure (Continued on page 2



PORTIONS OF THE IRON ARC SPECTRUM

e of the bright apertral lines are marked in international units of one 18-billionth meter those secondary standards. It will be noted that the photographic plats is sensitive in both direc-tions far beyond the limits of the human eye

Visible and invisible portions of the iron are spectrum

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Various Arts and to Patent News



The device that enables the driver to protect himself from glare

Bright Lights-But No Glare A LMOST everyone who has sought to
A solve the glaring automobile head
light problem has gone at it from the
standpoint of dimming or diffusing the
rays of the headlamps by mans of special lenses, shades or other simila apparatus, falling to recognize that it is practically impossible to subdue the rays of the oncoming lights to the extent that they have no glare without sacrificing some of the road illumination for which they are put on the car A solution of the problem from the logical standpoint would be to make the driver immune the bright rays of the oncoming car thus embling the other fellow to have the needed road illumination without in one was affecting the driving vision of the man whose car is properly equipp

A well-conceived attempt to do this consists of a small black-enancied plate of sheet metal attached to a ratchet device to enable its being adjusted to s desired angle. It is arranged to fit the top of the windshield by a universal holder (a special fitting is provided for enclosed cars), and the right edge is



The latest convenience for the man who works at the edge of the roof

set on a line with the center of the steering wheel In the daytime the metal shield is swung up out of the way being held firmly in any position by the ratchet mechanism In use, the shield is swung down at such an angle that the driver can look out under its lower edge and see several hundred feet ahead to enable ample driving vision while at the same time the dazzling rays of the other fellows lights are excluded by the metal plate. A few minutes ex-perimenting will show the driver just which is the right setting for his car and his height, and once properly ad insted it need never been disturbed

What Is Glare?

THE sub-connittee of lighting en gineers that has been examining the nature of place recognizes, in its report, several distinct varieties "Veiling place" is produced by light somewhat uniformly superimposed on the retinal image, thus



When the elevator is idle there is no obstruction to the sidewalk

reducing contrasts and visibility, and corresponds to the fogging of a photo-graphic plate 'Dazzle glare' is pro-duced by adventitions light so refracted and scattered as not to form part of the retinal image "Scotomic glare" is pro-duced by light of intensity such as to fatigue the retinal sensitivity below the concurrent limit for usual images, and corresponds to over-exposure in photog raphy the influence of these three forms of glare is analyzed and some experiments made to determine the man nitude of the effects described. A target on which the black letters in various positions were distributed, was illum ated by a concealed source. For the aps were mounted is hind a small cen tral aperture in the target and for producing extreme dazzie glare an automo-bile headlight was (Nessel Velling Liare was preduced by superimposing a lantern slide so as to cover the field of view and tilted so that an image of an illuminated surface was seen by reflection—the target was thus seen through a luminous base Quantitative data, illustrating the reduc m of visual acuity are presented. It is concluded that darric glare is of the most serious consequence, and some sug gestions for further experiments made.

One-Man Railway for Roof Workers

THE Seattle Daily Times has installed on the top of its six story newspaper the convenience of workers on the roof A little car located on the roof carries a 200-pound counterbalance, which cir-cumnavigates the roof. The photo shows how a man, standing in the platform suspended from the car, can reach all comice lights on the building

Double-Lever Steering for the Flivver

WHAT the driver of the small car with its direct lever steering con nection instead of the more effective worm your, needs more than anything control like our in an emergency, to prevent the wheels being period out of his hands or the locking of the front wheels is neath the car. The principle of compound leverage is utilized to give blin this increased power in the steer-ing device illustrated berewith. Instead of one bull joint and one lever as when equipped steers through two levers and two ball joints.

In installation the single lever c off the bottom of the steering post and is replaced by the compound lever 1, which actuates the steering arm B through the fulctum provided by the ball and socket Joint C. There are no

An Accident-Proof Sidewalk Elevator

MONG the features of modern city A MONG the reasons of an address of danger to life and limb when not properly safe guarded is the elevator shaft rising at every large building disposes of its ash by thus beinging them to the surface. and more than one pedestrian has been killed or injured by suddenly baying a section of the sidewalk disappear be-neath his foot or fly up into his face to make a place for the elevator to rise

the provision of gates and warning signs is not sufficient as is amply proved by the number of persons killed at well protected grade crossings. What is



As the lift rises the doors open and

needed is something that absolutely preneeded is sometiming that most outer pre-vents the clevator from rising when there is any reason who it should not rise. We illustrate the installation de-signed by a New York concern which

does this When the elevator is inactive the gates fold back against the wall as shown in the first view. When the control is thrown over to start the elevator upward a stentorian ringing is heard for some little time before the flat doors in the sidewalk break at their central in the sidewalk break at their contrac-point of junction. With this breaking, the gates swing out. The last possel billist that somebody might is hurt is removed by the fact that any weight on removed by the fact that any wight on the rising doors, or even so light an obstruction as a hand placed upon the swinging gates will hold the elevator motionless until it is removed. The whole



Compound-lever steering for the car that lacks a worm

amaratus is so interlecked electrically that it seems absolutely foolproof

Residents or visitors in New York who are interested in secing this clevator in operation will find a typical installation at the Park National Bank on Fulton Street, Just off Prondway

Short-Wave Oscillator at Low Pressures

I experiments with triode tubes given ing wave-lengths of the order of a meter Barkhamen and Kurz found a type of oscillation apparently due to the motion A experiments with trick tubes giv of electrons in the tule limit indepen dent of the external capacity and indu Whiddington observed lower frequencies and attributed the effects to the motions of ions instead of electrons Gill and Morrell have given an explana tion involving the natural oscillation of the electrical system connected to the Previous investigators used commercial tules incapable of modification

I I Nettleton now reports in Pro-ceedings of the National Academy of Sci-ences December 1922 experiments with a tuls left is runnently connected to the vacuum pump and made with a ground glass Joint to make the internal parts gliss John to make the mercoac parts accessible for modification. Lectron cur rents as bigh as 300 milliamps and voltages as high as 700 were used. The errangement is illustrated. A becher circuit was used and to measure the wave length a thermo galvanometer was hausen type at wave lengths of 50-200



When the elevator reaches its limit of travel the shove appearance



Another article for the home beauty-factory-a marcel waver

on were obtained, and the occurrence of a negative plate current demonstrated Both oscillations and negative plate cur rent ceased at very low pressures. The sured by the resultant ionization

A Versatile Woodworking Machine

A MACHINE operated by electricity which will do almost any sort of work done in the woodworking indus tries is a recent development of a Cin mounted on four wheels with a three-

of construction allows a very quick change to be made from one tool to an other as a matter of fact it is claimed that the change is made as rapidly as if one had to look for the desired tool in a chest

After the tool is made up it is the xible and is suspended over the work and in use is pulled down to the work and a belance taking place makes it possible to relieve the work of any un evesory weight
It is claimed that a compound miter

such as the top of a hip rafter is made as castly as a square cut and all opera

abrasives can be left in the cylinder wall, to continue cutting after the en gine is assembled and in operation. The hone fits itself without adjustment to any cylinder from 213/16 to 5 inches in diameter For larger cylinders, ex-tension blocks may be set into each wing of the hone, and it acts automatically as before. The hone is designed to be driven at speeds of 800-1100 revolutions per minute, by a portable electric drill, standard drill press, or other rotary

Beauty Via the Marcel Way

As the creation of beauty is a part of the pursuit of happiness the lady with straight locks considers the acquisition of curis one of the legitimate ambitions of life! As a means to this end there is manufactured now an electric mores I waver for individual home use at a price practically the same as the at a price practically to sail in batter makes of electric curling froms, llitherto the lass with the bobbed tresses and the nutron with white hair have had to depend upon visits to a beauty parior to obtain the coveted mar-cel wave. As the waver has two heating clements, between which the strands of hair are laid, the heat is evenly applied, and our picture shows how three waves are made at one operation



Longitudinal and lateral springs on the

A Novel Spring Assembly

DESPITE the unanimity of automo-bile manufacturers—withholding for the moment the admission that the tin lixie is an automobile—for the longinixie is an automobile—for the congruent tudinal spring, the lateral type that characterizes the genus flivver has its advantages. Some such thought as this must have been in the mind of the California inventor who designed the combination we illustrate herewith in which an attempt has been very obviously made to hang both types of spring upon a single cur. Across the projecting ends of the conventional longitudinal springs a heavy bar member has been



The all-around woodworking machine, shown in a few of the many uses to which it may be put

Mitering or beveling

point suspension so that it can run on a track on a curpenter s bench Its posi-tion on the bench is such that the flext drop hangs over the work side of the bench A 14 horsenower motor develops sufficient power to work two-inch stock and under The tools are mounted dreis individually which are in serted into a hollow spindle to which the driven pulley is secured. This type



Sectional and longitudinal views of the cylinder hone that automatically ad-justs itself to the size and center of cylinder

tions are done while the timber lies on the brach A stair horse can be cut, it is claimed as quickly as a man can lay it out, with a square and pencil, and the steps are cut square while the risers are cut either square or mitered. Where mortise locks are to be made the doors are stacked up near a work bench and

wenty mortises, countersum for the face of the lock may be done in an hour The cutter supplied with the machine will do all the simple moldings, bending, tonguing, grooving and splining. To take the place of an ordinary brace and bit a boring mandrel is supplied. For screw driving work a bit with a counter-sink right on it is used and this makes the hole and the countersink at the same

An Automatic Cylinder Hone

DEPENDING upon centrifugal force to expand it to proper size and to force the individual stones into contact with the cylinder walls, the new hone recently put out for automobile use by a Chicago firm is self-adjusting, selfcentering and self alining. In this way is insured equal pressure on all stones with the elimination of springs and the prevention of unequal pressure upon the stones. The stones polish the metal surface without the use of any liquids or lapping compounds and without filling This is a great advantage in that no

The Folding Toothbrush
DENTISTS agree today that one
habit worth forming is to carry
a toothbrush if you are away from home for the entire day. This brush has been specially designed for this purpose. The brush separates from the container and goes into it when not in use. The case is metal, ventilated for drying, and is of such a length that it will fit many places—among them the vest pocket, placed, and below this, attached at both ends and in the middle hangs a very flat spring, cross-ways of the car The front axle is supported, not on one of these and through that one upon the other, but actually in part on both The result is claimed to be extraordinary success in actually taking up, in the springs, without transmission to the body and without the use of shock shorhers all the joits of heavy going.



The teethbrush that folds up and goes in the pocket



Handy carrier that reduces milk bottle casualties

No More Spilled Milk

IT is the fate of children as will as fgrownips some time to ere over agrowing some time to ere over applied niffs." The faugits mift bottle when held with other kitchen supplies will ally from the hunds or arms of the carrier A buttle carrier alsown here better the state of the same of the same of the buttle safely. If previous a modern hundle, when held as shown, which becks the two wire supports security under the rim of the bottle top

Daylight Reflections in Show-Windows

poll-BHED plats gloss forms an excellent mirror, and rates those of brightly lituminated objects in streethess of brightly lituminated objects in streethess are gut to be formed at the gloss of show windows, interfering with the officitive made to overceion this busing curred glass, but the lower edge of the glass is then located 1½ to 2 feet behind the formit line of the window and such spacial gines has other drawbards. Incomlarities that the surface of the conlination of the surface of the contribution of the control of the contribution of the control of the control of the control of the control of the conlocation of the control of

In transactions of the American II luminating Engineers Society for December 1922, Harrison and Spaulding



Combination laundry outfit that in-

describe the use of six foodlights, yield ag 25,000 agregate andisposar to over-come such effects. The lighting units were mounted in reveases in the ceiling, and the such panes of diffusing aliass, and the analysame of diffusing class, and the analysame of diffusing class, and the analysame of diffusing class, and the analysame of diffusing class were hinged at which the reflectors were ittel could be adjusted within wide limits so as to en any desired effect. The frames centaining the diffusing class were hinged sides overcoming the diffusing through the diffusion of the diff

Light-Weight Radio Set

Titled little radio set held in the paint of the hand can also be curried in the pasker Its manufacturers claim for it that it is sturdy and dependable and not in the least a toy. Its tuning in facilities enable the user to cut out all interference.

all interference.

All that is necessary for enjoying radio concerts while hiking motoring or camping is a beadset and a few feet of wire to hook up to a wire fence and ground.

Screws On but Never Off

Screws on our never off Tills mechanical arrangement for lock ling this radiator cap in place is in treating A bushing listide the capcutation a firred for screwing on to the radiator play. This bushing is arranged of the a ratched so that if will a move in the second of the cannot a move it.

In addition to this feature it elimin ates the trouble and time usually necessary to remove the regular radiator cap



Theft proof radiator cap that springs back to admit water

for filling the radiator with water. To fill the cup and motometer turn back with a spring arrangement. Removing the hand springs it forward over the opening.

The Cottage Laundry

FOR the summer shack or small cot tage that is not provided with laundry tubs, this combination of tub, wash loard and boiler in one will be found

convenient

Many small articles that must be laun dered frequently can be cleanæed on this tub board. It is used as shown.

Static

SIX papers in Bodom lectriciti, issues for July, 1922, deel range, 1923, deel very throughly with the various possible sources of intempheries or "parasites" encountered in every day practice of where set telegraphy, and discuss in every great defail the numerous methods which have been employed by the authors and others to eliminate the trouble. In the Bright has the paper the authors classify atmospheries

(a) Atmospherics due to storms (accompanied by lightning flashes), (b)

local atmospherics—due to voltage fluctuations in the atmospheric layers guerathe reverling certain the reverling certain the reverling certain the control of the boundaries of our planet, possibly having solar sources, (d) musculancous—presence of clouds (emperature of the air, atmospheric pressure, etc.)

atmospheric pressure, etc. of the artificial and animospheric pressure, etc. of durant and consult artificial and etc. of the artificial and artificial animospherical anim

(a) Continuations of high frequency (ir uits—1; sea not a servicits, (b) and to determine (b) composition of contesting the (Round's double crystal) or double-stone included—in which one detector is sensitive the other less smaller and in opposition, (r) saturated systems (Marcoul Wright assume—limiting, the



This month's radio midget

as etimum amplitude of the "strate he indipotation of valve switch mer softe ration current (d) indecellaneous Marcoal's included in which is modal point (for a certain wavelingth of recipiton) in the antenna circuit is consisted to earth. The "strate of different wavewhile the timed shands are transmitted through the receding circuits. In the month name, Systems invented by de-Groot, Pupila inequity resistance in the Groot, Pupila inequity as significant

For the computision of efficiency of variations as systems in liminating parasites the authors have devised a manus of man suring the ratific Interestints of the depending on a new principle is developed and various modifications of the method are described in detail. It depends in principle, and the observation pends in principle, and the observation gated in a direction normal to the surface of the earth.

Centralization of German Long-Distance Radio

In order to fullitate accreems rather as exceeding that a receiving state has been installed at Goldow about 90 librouters in a smallerly direction from Sharer V with a construction of the latter with being and for consumination, with New York, using the auditor of the construction of

No Dust Escapes V4(UUI cleaners have come into ex tensive use in the home, but there

is still some dust for the dust pan
None escapes this improved pan because of the wire arrangement shown at the back of the dust eatcher. When the foot is applied to the wire the front



The dustless vacuum cleaner

of the pan bugs the floor, permitting no

dust or dirt to escaps underneuth.
The short handled dustpan should be no more. This long, handled one takes the stoop out of stooping, and when rulest carries the pan in an upright position shutting the dust inside where the transaction.

A Better Barometer

A BIOID homometers in use since the seventeeming centure have all been constructed on the same lines. They are rather unrialible and owing to friction and closely returning the year of the and closely returned to the close to the construction of the construction of

As altitude notice the new instrument is expected to be of fundamental funperiance to the nature. In rapid descent instruments of the old type were often 2.5 or 30 notices in error while the Paulin cuttle cum hardly to move than one more off. The Instrument is not applied to a lare, number of other paraposes, such as ground surviving influe and artifliers determinations et a spe-



Two views of the newest and most



Lubricating an automobile chasse by means of the high pressure arstem

cial light type is offered for such uses as these Also in naval and mercantile marine uses the Paulin ancrei 1 sh uld give a far m re accurate weather f re cast than its predecess rs

High-Pressure Lubrication for the Automobile

FOR a true appreciati n of automo bile charsis initicati n it is need sary for one to handle the old fashi ned messy grease cups. These cups are filled with grease and screwed d wn so as to force grease down t the bearing sur As offen as not the cups no

faces As a free as not the cups not being sufficing filled failed utterly to part run their function with the result that rug id ware soon asserts itself in high repair tills American 1 decelor | 1 mingrations American 1 decelor | 1 mingrations | 1 mingration | 1 mingrations | 1 mingrations | 1 mingration | 1 mingrations | 1 mingrations | 1 mingration | 1 mingrations | 1 mingrations | 1 mingration | 1 mingration | 1 mingrations | 1 mingration | 1 mingr grease cups and by means of a hand compressor the lubricant is freed into the bearings under a pressure of 500 pounds to the square lack. This method has a deuble advantage for while it is furting the freed lubricant in it is fulled the freed for the state of the country clean bearings at all times it country clean bearings at all times it and the state of the country of the country country of the extra country country of the chassis extra 600 miles every 500 miles

The high pressure lubrication system can be had with either a flexible hose



Gas mark intended for the use of train crows when passing through

which makes it easy to reach the la-accessible lubrication points or with a new spiral valve compressor in which the compression is built up before apply-ing to the fitting and is autoensicially released when the connection is made. With the spiral valve compressor either ell or solidified lubricant can be used, under a pressure of 2000 nomeds are on or solidified lubricant can be used, under a pressure of 2000 pounds per square total

One of the greatest difficulties to over-come in lubricating automobile chassis is clogged bearings. Sometimes espe-cially in tight fittings the greans hardens, and cakes and when fresh lubricant is applied even under forced pressure the applied even under forced pressure the resistance is so great that the old grease cannot be dispoiled. If this condition is not runedied the dirt and grit in the bearing goes on chipping and grind ing away until the bearing is ruined. To solve this problem a pump has been invented which is expailed of develop-ing a pressure up to 5000 pounds per guare inch with its sunficient force to

aquare inch which is sufficient force to clean out any bearing no matter how body togged It is a simple piece of the piece of the piece of the piece of anyone using the regular equipment Another fagure of .ishi hubelanion system is an all modal jubricating spring cver made up of overlipping size hightes which give it the necessary pliancy and freep out draw and water while gestialing keep out dust and water while scanning the lubricant Under the pressure of the lubricating compressor the lubricant is forced in between the leaves of the spring provided with the cover

The many advantages of this high-

Heatilght Focusing Problems

Office who observed curvality the anywrite consistency that he meets at significant
will reach the conclusion that a large
will reach the conclusion that a large
solved if every driver were compalied
forms his lamps properly it is hardly
an exaggreation to say that in a majorty of cases the baselights are impropit should not and creating shadows
where there should be light.

The parabolic reflector in universal
tas on heed lamps has what is known as
a fixel point and possesse the propose,
point, and reduced from any point what
ever of the mirror, will all be sent out
takes attentioned the property we must
focal point of the mirror.

The takes attention of the first of the
facel point of the mirror.

The takes attention of the first of
facel point of the mirror.

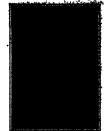
The takes attention of the first
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The takes attention of the first
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The takes attention of the first
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The takes of the focal
the focal point of the surper
the top of the first of the reductor takes an

that pass slight downward. The rays
cross somewhere inside or outside the
hollow of the reductor and the resulting
illumination is open to two objections. hollow of the reflector and the resulting illumination is open to two objections only half of the light fittle upon the road only half of the light fittle upon the road well as it might and should be not the their half passes outward and upward at an unnecessary and Higal height, and at unnecessary and Higal height, and approaching driver nests the diagonal slong, which he rays are progressing. No hon glare system in the world will eliminate these delects unless the ismp



An Automatic Dispenser of Chocolate

An Automatic Dispenser of "THOM I Automatic Dispenser of Chocolate I. Under I and the Companying The I there are no companying the Chocolate I action of laving the chocolate all prepared, ready to be served this machine prepares the addition of the requisite writer or mith and the proper best, in the space of twelve seconds.

The machine of operated by a small of the special concreted in Ampaire which performs its work upon the introduction of a cell or a special metal check in the slot A glass reservoir on or saier as the case may be Another reservoir holds the cooks in powdered from mixed with the required peoperation of magar. Upon the introduction of a contract of the case may be about the correct amount of milk is heated by a steam jet, and the cococa and snaps prowder is introduction and control one of the correct amount of milk is heated by a steam jet, and the cococa and snaps prowder is introduction and control one of the correct amount of milk is heated by a steam jet, and the cococa and snaps prowder is introduction and dispussing liquids but sneethers for a cup. We have had slot machines for dispussing liquids but some that concocted the drink before serving it.



The dark spot in the beam of an automobile headlight, as shown here, is caused by the bulb's being out of focus

pressure inbricating system have made it a standard feature of 8000 000 motor curs me in use Besides it is finding many industrial applications, where good tive inbrication at frequent intervals with a minimum of labor is a pre-

A Tunnel Mask for Locomotive

A funnel mans. for Locusevite Crews.

[Till' mask shows in the accompanying illustration has been designed for use by angineers and other trainness for protection against gasses usually esconditored in tunnels and also as a protection against intenses beat and escaping. steam or from flying glass caused he the breakage of the water glass. Indeed

steam or from flying giase caused by the breaking of the water giase. Dieed, the mask is expected to protect its the same of t

in first property focused. If the lamp is even of focus of the lamp is behind the fixed point the ultimate result is the name through differently artifaced. Here the rays are weighted to he had been to the lamp of lamp of the lamp of lamp of

Placing the Watch on the Séser-ing Whoel

A MONG the latest estrocodile appliwatch as a device for holding a
watch on he scenary when of the crirangement that clemps to the rise of
the wheel and holds the watch in such
a position that the time may be readily
install a thougheen on the degle of a cor,
as it necessities exiting a hole in the
wood or need daubhorst, whiles a deale
comes as regulable explanation, on the stall



The Motor-Driven Commercial Vehicle

ned by Major Victor W Page, M S.A.B.

The department is devoted to the unterests of present and prospective owners of motor trucks and delivery suggests. The editor will endoesor to answer any question relating to mechanical features, operation and management of commercial motor vehicles



Combination specialist and fusion for

Two John from One Watering Truck STREET-CLEANING and street main

to the meter-truck manufacturer for the lesign of valuable combination outfits design set valuable combination outfits mounted on more or less conventional chassis, and embodying the apparatus for all nexts of public services jobs. In the combination was the public service jobs. In the combination watering curt and finsher Historicated. Funshing has cottl narily been a job for a man with a hose but when done so, it results in great waste both of labor and of water. The light pank Historicated will sprinkle when spruisible; it is redee and when flush pank in the public pank in the control of the public pank in the pub

A Motorbus Chair Car

A Microstrum Chair CarA W Binovation in subrona managerA relation like been insurgurated beresen Toungstown, father and Beet Pail
evines Ohlo, by the installation of fear motorbase chair care, these correspond tentes. The chair care de luxe is mounted to a modified truck or special bus chassis, especially designed for passen to the company of the company of the com-tent of the company of the com-pany of the company of the com-pany of the company of the com-pany of the company of the com-tent of the company of the com-pany of the company of the com-tent of the company of the com-pany of the company of the com-tent of the company of the com-tent of the company of the com-pany of the company of the com-tent of the company of the company of the com-tent of the company of the company of the com-tent of the company of the company of the com-tent of the company of the company of the com-tent of the company of the company of the c

rvice has aroused keen inter among transportation men as it can be used for chartered trips and for every sort of social uses as well as in more utilitarian fields.

One-Man Road Grader

THE grader illustrated is an attach neat so constructed as to utilize the A ment so constructed as to utilise the weight of a poyner small render on a well as the power delivered by it in the op-section of the grader. The stratchments easily made. The frame is of stand-ard six inch section steel channel and all castings are of electric formace steel carefully hast treated. It is possible to apply a ton weight on the blade of the grader where it is necessary (to cut grader where it is necessary (to cut hard spots in the road surface) with out taking the weight from the traction wheels When the grader is making a heavy hard out it is impossible to silde the rear of the grader sideways due to the distribution of the weight on the

the distribution or the weight on the rear wheels.

The grader blade can be tilted and angled to any desired positist by the operator from the grader platf rm. In the method of applying the one-man grader to the small tractor it puts grader to the small tractor it puts 1200 pounds of weight on the front axis which is the sume weight as the axis originally carried under the cracter or the same weight as the axis of the same weight as the axis of the same which weight as the same which weight as the same which weight a same weight as the same weig structed of steel throughout using heavy steel castings where castings are re-quired. The grader as well as the trac-ter is carried on roller bearings having in addition the best possible method of

lubrication. When equipped with rubber wheels this combination mounted on relier bearings makes a most ideal equipment for road maintenance work as it will make a speed of eight to ten mike per hour on highwavs where that speed is required for traveling from place to place quired for traveling from place to place quired for traveling from place to place and a working speed from one to ten miles per hour at the will of the op-erator. Any speed chosen by the opera-tor is maintained by the angine speed governor The 18½ foot wheel base of the machine gives the unit a wonderful leveling effect on the road as the blade



The ene-man road grader

is carried between this long wheel base is carried between this long wheel base with the a nersl of the mot r left to the givern r the operat r has only the gear slift and clutch to operate b th of will have conveniently handled from the 11 if rm and these contribious be handled as easily as from the sent of the truct r After the grader is in moti n tie entire attention of the operator in a the entire attention of the operator nay be a neestrated up in the grading work as the tractor automatically cares for itself therefore one operator can bundle the machine with case. No hin lie the machine with case No skilled perater is required t han lie this a uchine but the claim is made that any ne can handle it perfectly in two or tirec hours time after limited instru

The grader moldboard is equipped The grader motipolars is equipped with a reversible cutting edge so it it two cutting edges are realized from each black. The cutting edges use I an I fur nished for the grader are special ligh earbyn heat treated steel to warrant the carbn heat treated steel to warrant the longest life possible for this ranged work When the grader is used for the maintenance of hard gravel r starcasts or for city or municipal work rubber wheels are used which give the unit the speed required for traveling from place 1 place and ample tractin for that cless of work When the srale are for that class of work. When the grailer is used in heavy road gradin, as in construction of new roads or subdivision with standard wheels may be used or for greater traction rigid rull tracks are

I r heavy snow removal the use of this grider gives greater efficiency at lawer cost than any other equipment ever produced. This single-unit tractor ever produced. This single-unit tractor grader; erfectly adapts itself to contrac tors, work as in doing finished graing the 19½ for wheel base gives a wonder ful leveling effect and as the black is ful leviling effect and as the blade is rigidit carried between the four wheels the grade can be kept uniform to a frac-tion of an inch In working between the firms the grader keeps the road leveled when cut up by trucks and will cut down hard high spots in the grade thus saving many men as it is handled a reguldy in backing up as in going

This grader is found to work well in This grader is found to work well in muddy conditions as the blade removes the sticky top surface shead of the driving wheels thereby slavary signa-the traction wheels a finished smooth surface to run on. In making or clean ing out ditches two wheels of the unit are put into the ditch with the blade set at any angle desired and the dirt is thrown up into the road. Hard clay

roads cin be graded when dry as well as wet as the tractor has plenty of power and wight to cut the hard uneven clay

Handling Eggs in Bulk with Minimum Breakage

Minimum Breakage

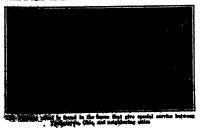
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la which i mut r truck is used comes
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c untry a citatin percentage of breakage of eags is expected even with the u f sie iil (rates and every safegnard is taken to protect the fragile freight but in Denmark many buyers handle the

gs in bulk

He has a 3000-is and track which he He his a 3000-pund trusk which he lads with -2000 tgos that weigh ap 11 chuntty 2"59; unds Mr Broegnard colls upen abut 400 farmers weekly buving 4.gs and 1 ating the in his truck. The tru k body is the regular express tipe with high flare boards added. Between the first nine or ten layers of about 1.300 eggs sech Mr Broes gas I places a layer of straw three-quarters f an inch thick. After that quarters is an incul titles. Atter that no protect in is placed between the eggs At no this ite fruck was carrying 22 000 (ggs vilued at around \$600 which is in av rus, daily load. It is said that the lr. ikuge of eggs carried in this m mer is no greater than if they were in nier is no greater taan it taey were jacked in the regular egg cases used in this country. After he has taken on about on half a load Mr Broegaard says that he is able to run his truck at full speed on solid tires.



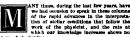
Special attachment for converting the tractor to grade work



The Heavens in October, 1923

Another Contribution from Atomic Physics to the Study of the Stars

By Prof. Henry Norris Russell, Ph. D.



we have already told of the new understanding which has come of the origin of the spectral lines— how the electrons, circling in complex orbits about the central nucleus of an atom, may have not one but central nucleus of an atom, hay have bot one out-many different sets of nossible orbits, and how, when a change from one of these states to another happens, the energy set free is radiated (or, perhaps, that re-quired to effect the change is absorbed) in the form of light of a perfectly definite rate of vibration, giving a

For some elements, such as sodium and potass the possible orbits are relatively simple. There are but a few dozens of lines in the spectrum and the relations of these have been satisfactorily worked.

of these have been satisfactorily worked out For others, however, and notably for iron and some similar metals, the spectrum shows thousands of lines, and conditions must be very complex These committees must be very complex. These cases defied analysis till a year or two ago, when a Spanish physicist, Dr Cata ian, working in the laboratory of Professor Fowler at London, succeeded in in-

rpreting the spectrum of manganese Whereas in a simple case like sodium pairs very nearly alike, in manganese they come in groups of three, four or even seven The transitions between them in-stend of giving rise to double lines, then mean or giving rise to dudie lines, then
may produce groups of nine, twelve or
even fifteen lines, arranged in a definite
but complicated way. Once the rules governing such "multiplets" or groups of lines had been found, the way was cleared for had been found, the way was cleared ror further advance. The intricate spectra of chronium and molybdenum yielded to investigation—notably at the hands of Dr Kress of the Bureau of Standards, and the latest news is that Dr. Walters, also of the Bureau, had succeeded in the attack upon iron, which seemed to be the most impregnable fortress of complexity There is no doubt now that we are within sight of the general solution of the problem of the spectral lines, and that within a very few years we shall have at our disposa a knowledge of the physical changes with in the atom which may give rise to the production of any given line in the arc

Equally striking has been the progress in the study of the spark spectra, which are given out by atoms from which one

ejectron has already been removed. A second electron can then be shifted from one orbit to section electron can then be shirted from one orat to another, giving rise in a new and entirely different set of lines, and after this has been taken clean away, a third and fourth may successively follow, giving two new spectra. Theoretically this process can be continued until all the electrons are atripped from the atomic until all the electrons are stripped from the ground nucleus, but usually, after three or four are gone, the radiations resulting from further changes are of such short wave length that they resemble X-rays rather than ordinary light. The electrons that are loosely than ordinary light. The electrons that are housely count attached to give rise to the relatively slow visual waves are usually the same as those that operate in ordinary chemical combination, so that the number of different specimal voltame is that which effects the "extractor" of the chemis—chough violent excitation often brings out one additional stage. Thus magnesiam has two well-known specims, alumingm these and efficient four hard papers corresponding to the company of the co the removal of the second electron from an atom are known—the Strt case being magnesium, studied by Fowler. Recently Panchen, in Germany, has worked out the spectra given by aluminum which is looking its second or third electron (the first has long been worked out), and Fowler in London has identified all four stages in silicen, though only the last has been published in detail.

What It All Means to the Astron

The resulting mass of information is so extensive that it takes a good deal of work to become master of that it takes a good deal of work to become master or it, but this show will be necessary for the student of the stars, and will repay him well. The reason for this is not her to seek. The atmospheres of the stars—on which the absorption lines that fill their spectra ser-which the absorption lines that fill their spectra ser-which the absorption lines that fill their spectra are which the absorption lines that the stars—on the large could be more fortunate for the satronomer, ser-hot rarveled gases are the simplest forms of matter agricult to concline with one another—indeed, in the star of the stars of the stars of the stars of the knotched off, and many two or three. The highest better the temperature and the lower the pressure, the larger will be the proportion of atoms in this disbeweiled stata. We do not have to guess at it, the difficult but power-ful averaginations of thermodynamics lead to formulae culations, which were first made by Sahs of Calcutta-culations, which were first made by Sahs of Calcutta-

At 8 o'clock: Nov 7. At 814 o'clock: Nov 16. At 80 clock: Nov 16.

oure advess are in St NIGHT SKY: OCTOBER AND NOVEMBER

An important extended using this line in jest been made by two presumes all and guidalment. System and Allins, of Cambridges. Consider a set of stars of successive hierarchical temperature, and the lines of a given demonst, each as allicon. At low temperatures of the control An important extension along this line has just been

pheres can then be calculated. It seems out surpris-ingly low—about one tan-thousandth of that of our atmosphere under ordinary conditions. Considering atmosphere under ordinary conditions. Considering the high temperatures, the density of an average etellar atmosphere must be less than a hundred-thotsapadh of that of ordinary air. This we would ordinarily oull a vacuum, though in a thickness of hundreds of miles it about abundantly suffice to absorb the ordinary

spectral lines. With this value of the density, we may proceed to calculate the temperatures of the hottest stars, which cannot be obtained satisfactority from their colors, as the latter change very little for great changes in benefactor. In this way; it is found that the stars with the strongest belium lines (called ES at Harrard)—like many in Scorpio and Ontatures—laws surface temperatures of about 15,000 degrees, while the stars of class the contract of contract leaf, probably run well over 25,000 degrees. A few stars are still hotter, but their

25,000 degrees. A few stars are still hotter, but their temperatures cannot be calculated until further laboratory data can be brought to bear upon the problem.

When the wealth of material which is already in sight or under investigation has been politized, and made security available, we may hope to be the to calculate with considerable occurring back or considerable of the control of the co the temperatures and the pressures which prevail in the atmospheres of the stars, and to do this for all the stars, rather than merely for limited groups of them

The Seavens
The faultir outline of the autumn constellations appears on our map. Aquila is low in the west, with Lyra north of it, and Cygnus above the two. The Great Bear swings low on the northern horizon, with the Little Bear above, and Draco on the left, while Casslopein and Capheus are hither above, the pole. Hereytoe and the serr, while Cassopein and Oppicus are higher, above the pole. Hercules and Gunlai may just be distinguished on the horison—the one caught in the act of setting in the northwest, the other just rishin in the northeast. Persus is high in the northeast, with Auriga below, and in the northeast, with Auriga below, and Taurus on the right above Orion, which is rising. The great equare of Pegasus is high in the south, with Andromeda above on the left. Aquarias, Octus and Eridanus occupy the huge dull region in the south, while the isolated bright star Formathaut shines, unattended, low in the

The Planets

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to the seas that here is precludily no chance of several fag ber,

Mars is a morning star, and in the middle of the
month is nome five degrees west of Mcreuty, nisting
about twenty minutes certifer Moreuty, being about ton
times the brighter of the two it this time, is the more

consequences are evening stars setting about 7.500 P. M.
Taplices are evening star setting about 7.500 P. M.
Taplices are evening star setting about 7.500 P. M.
Taplices are the beginning of the month and soon becoming lost in the vivilight. South in the set out, and the set of the things of on the 17th, and the travilles. Urrains is to Appareise, and the covere the meridder at 9:30 P. M. on the 45th. Neptrate is in the venture, adopt of the stay, and freeze

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Recently Patented Inventions

Brief Descriptions of Newly Invented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

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R. New York, N. X. The invention relation
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GARMENT,—A. ROOME, 850 E Seck St.

ry easily applied and removed.

GAMMENT—A. BOOKE, 859 Beck St., remr. N. Y. An object of this invention sides in the provision of a garment in senature of a cornect the parts of which are be adjusted to saught sendred the parts if the waters's body and to conform to the contact that the contact is the waters' body and to conform to the contact the sand irregularities thereof. A recunarities and irregularities thereof. A further object is to provide a correct which fidently supports the back and retains the sust in a desirable manner, and also con-ness the lips of the wearer, to cause them a present a rounded appearance.

PATENT FACTS WORTH KNOWING—1

The pick of the Invention is to provide means of the provide and the provide of the provide and the provide of the provide of

Of Interest to Farmers

Of Interest to Farmers
TRACTURA.-I. J MITCHEMA. Huntington, W Va. The object of this invention is
to provide a trector of the line of central
type which is easy to manipulate and familie
in coperations and capable of develop a
relatively large load and turning around in
comparatively and space. A further object is that the outpus sesseciated with the
restor may be utilised for belt work if so

Translation and the contraction of the contraction

COLTER ATTACHMENTS FOR THACTORS—B. W. Morrow, Willson. Fla
This invention more particularly relates to
the names of attenting a color to a rector,
the color may be subjected to a yieldishe
resure for causing the same to penetrate
the soil over which it may operate As inmeasure for causing the same to penetrate
the colir own yo rightly hald against upward movement and thus establish a certain
depth at which it must penetrate the soil
from the color may color the color own you.

results accurately indicated.

VOLDING TENT—B. B. DUDLET, Visalis, Calif. The object of this invention
is to provide a tent of substantial propertions that can be con-sessedly folded into a
small bundle salepted to take up little space
in a camping outfit. A particular advantage
in that the out provides sufferent bead room
is that the outperform of the presence or a number of persons to stand
bound. and have the confort of a room in a
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upright and have the confort of a room in a ATTOMATTO PASSOT. BARREWELL, —If M MITCHEST, 255 Ilyrie St., Stan Francisco, Calif. Among the objects of the Francisco, Calif. Among the objects of the for sharpening a posent that will work automatically unon the insertion of the pseed. And will give other a chiest point, as new control of the conformation of the confor







Fig. 2. Charactic belifier with all





Pig. 5. R. H. Irwin's newly designed garage in

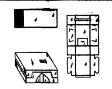


Fig. 6. A novel way of partnering tolded thomas paper for investment, derived by L. J. Armes



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unbattome here here intercepted in a system continue and tomos devel plant, in fact many impaired or comprode, which filter bed positively in small in practically any plane where it such expense of the waste vater into the ground in a perfect date at a point vater in a impaired in a perfect date at a point where it is angular relationship. The foot is part before the state at point where it is angular relationship. The foot is part before the property of the state at point and the state at point at the state at point and the state at point at the state at the state at point at the state at point at the state at point

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the return and for absorbing absorbs and jars
without transmitting such shocks to the receptable. The device to of relatively simple
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nfactared. BLILDING CONSTRUCTION—B. H. W. 18-11. BLILDING CONSTRUCTION—B. L. MATCHON, 15-11. BLILDING CONSTRUCT AND CONSTRUCT

LOCKING JOINT.—L. W. MUNEY, 48 Leater St. West Haven, Conf. As object of the invention is to provide a locking joint which will take the place of the ordinary

direct notines with the compartment to occupied (See Fig. 5).

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DISPLAY RACK.—O. J. Hotaline, S. D. Display Referes Ark. But Opens, N J The invention religion in E rent designed for hold-in reversion; inflammes er periodicals in which is displayed Systems at hermalizade. An ob-

its more particularly to cashe plate which successfully and after temperature of the property of the subject or green marker, the property one of a ballet or green marker, the property one of a ballet or green marker, the property one of a ballet or green marker, the property of the subject of the principal objects of the property o

DOOR LOCK.—S. R. STEVERS, 24 Stone
St., New York. N Y The invention relates
to a door lock of a semi-automatic nature
which is adapted for use in connection with

Heating and Lighting

Hesting and Lighting

Hesting and Lighting

STUVIPIPE REDUCING JOINT—M.

Lawn and one Pury Star, Allowy, Ore converted to the property of the

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and inserted into another with a mislatum CONCRETE RLOW MACHINE — W A WITTEREA, Ashwills N. C. Among the holpeto of the investion is to provide a lag means whereby the sides and ends of the manual backs of the service of a single lever so that the manual backs are several ratio position by the operation of a single lever so that the manual backs of the service of

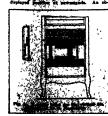








Fig. 11. C. Mottler's grain sleve



Fig 12 I F William



Fig. 13. Hand-operated retary concr.





Fig. 15 Moved high-cap attendment, per

composited to fix opposite edges may be designed of solutifies, are or other foreign (all such than it as used during the elevant expanded and damped to conform to the communities into the harval and to prevent the on the charge canning the train to run exemption always of shows or casings for the injust red fluid from being withdrawn from and resulting in a saving of expense in label withequare to the variance of the communities.

WINDMIII -I F WILLMAN Mules

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WINDRIII 1—I F WILLIAM Mileshos WINDRIII 1—I F WILLIAM Mileshos WINDRIII 1—I F WILLIAM Mileshos William Wi

control of the contro

Medical Devices

SYRINGI — O R. Schwisstrikt, c/o Becton Uckinson Co Rutherford N J The object is to provide a gyringe arranged for convenient filling and restilling with a serum netably one that is used for local ansethedia Another object is to permit of restling while the syringe is applied without

the t in into the sylvage coperation.

TRI.88 — G A BERRY, Modesto Calif This investion relates to a truss for berais and has for its general object to provide a constituction that will result in the truss being firmly maintained against displacement when applied and that will afford the multiple confidence of the co

Prime Movers and Their Accessories

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INTERNAL OMBURTION ENGINE

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INTERN Prime Movers and Their Accessories

Ballways and Their Accessories

FIG. HE TOY—B. NATAS, 120 Morn.

Ballways and Their Accommenders.

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DEVICE UTILIZING THE TREPITA
TIONS OF VERICUES—M. A. CASALE
Aller Argenting The Investor relates to
a device to be placed in railway cars street
to car of satiller velocies and where the detions or statiller velocies and where the detions or statiller velocies and where the detions of satiller velocies and where the
the running reliefs are used to sutmentically
move an advertaing or displaying tape which
is to be continually or intermittently moved
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Pertaining to Recreation

Pertaining to Recreation

TOT—I Perent Siff Are M. Brook
Iya N Y The object of the invention is
to provide a construction which may readily
be actuated by an operator and which which
council his efforts A further object is to
provide a toy which the operator blows into
council his efforts A further object is to
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dots.
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arranged to face one another and in the figures may be caused to move to late action as in a fight. A further us to provide a toy which is inserpess manufacture and not liable to break

Pertaining to Vehicle

AUTOMOBILE HEADLIGHT.—W. D. Orr and H F Gauryn, Brewnide, lawn. Among the objects of the invention is as provide a unitary headilght which will divide the light energy emitted by the Blushers into three distinct spaces. A further object into three distinct spaces. into three distinct spaces A further objects to provide a light which process a further object to provide a light which process a relatively dis light in the space which nemally in the process and the space of the provide a light to the space which nemally be brighter beam illuminating the general at a distance in front of the ear, and a third beam illuminating the ground at third front of the ear. QUIVELE STOPPENS

front of the ear CLATCHS ROLLERS—F F WUTTERS, CLATCHS ROLLERS—F F WUTTERS, Valley Falls, Kan An object of the hyen-tile is to reviewed an attachment or a resulter whereby a circle continues or a resulter whereby a circle continues or consider the relaxable hald in position to consider the relaxable position for consideration of the driving connection between the angles of the tractor and the transmission thereof without themsurging the gears of the transmission. The derivant was a smalled at the contract of the contract

landing of the driving connection between the Activation of the Control of the Co

and the desirability assured without impairing the level depositions of the plate as a will only the control of the level depositions of the plate as a state of the level deposition of the plate as a state of the level deposition of the plate as a state of the level deposition of the level dep

machine elements.

AUTOMOSULIS HOOD.—J M. WOLL,
Klitansing, Fa. An ehject of this invention is to provide a hood construction which em hodies a double top wall offerring as air circle and the second of the second control of the second control

AUXILIABY SEAT FOR AUTOMO-BLESS—8, R. GRAST, FOR AUTOMO-BLESS—8, R. GRAST, FOR Oskiand Place, Royal, N. T. The principal object of this formation of the provision of an energency seat which is adapted to be par-ties and the provision of an international contract of the par-ties of the provision of a provision of a with the regalax seating expectly, and which includes means of sulprament to practice type with the regalax seating expectly, and which includes means of sulprament to practice type and desire.

seat applicable to machine of various types and disses.

"THAOTY J. Hoovers, T. D. 180; I. 180

interfering with the peals action in any CONTROLLER FOR MOTONS — W. PARRAY, & Ressell St. White Pinian N Y. The invention has particular reference to manually operated controllers in the Stem in the providence of the control of the providence of the starting box in the providence, an especial movement of the handle of the starting box being received the starting box has been been seen to be a possible of the starting box being received the handle of the starting box being received to handle of the starting box being received to handle of the starting the busque to the changes of the starting the busque to the changes frame, and whereby the bumper may

lowing of the vehicle until desired, and thus vehicle.

EXTENSION BOILY FOR AITCOMO TWIND THE AITCOMO THE AITCOMO

way,
GAGR.—L. Foors, Pedro Miguel, Canal
Zone, Panama. This invention relates parficularly to water gages adapted to indicate
whether or not the water in an automobile
radiator has fallen below a predetermined
level An object is to provide a gage which

sunberiesd removal. The kniker is constructed with constantent to the provision of a dwelce structed with constantent of the two constructions. The constant of the constant o

brake band, and in addition will function to prevent lateral displacement of the brake band.

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be prevent lateral displacement of the breaks SELF - ALDIEVINI OF HEADIGHT — WHI CORNWAIL, SORI Lincoln Area, Onlined, Call? The invention has particular scales of the control of the con

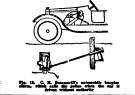
brakes to be applied. (See Fig 16.)
VILITICAE WIRESIA—B. (KERZA, Box 48. Illgranum, Conn The general object of the invention is the provision of a device for the connection with the connection of the connection

desires may be employed for aeronating the thoroites are of the eveloperity studies and the thoroites are of the eveloperity studies in the thoroites are of the eveloperity studies. The thoroites are of the eveloperity studies are the eveloperity of the evelop





Php. 27. R. J. Eryans has designed a new state





Pig 19. The latest nevelty in automobile tires, the invention of C. Berker



Fig 26. J. H. Dair's self-acting device for locking the differential when it is not in actual

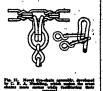




Fig. 22. O. B. Willer perky

of the springe, and at the name time pormit of positioning the loofy of the car at a mini-mun height from the axise.

TERE—C Decrease, 760 reveal Am., 12 re

(See Fig. 18) — STOCK ABSORDER FOR MOTOR STRUCK ABSORDER FOR MOTOR VEHICLES—JO DEZARO, Ave Masker For III of the See Motor III of the S

The parties of the primary objects of the invention is to provide a gaparatus which we utilized as a continued by a continued and continued and the provided and the continued and the continued are continued in a continued as the provided with means for protecting the continued are continued in a continued as the provided with means for protecting the continued are continued in a continued as the provided with means for protecting the continued are continued in a continued as the provided with means for protecting the continued are continued in a continued as the continued are continued in a continued and differential are which the beaking action is a continued by a passing a possume part to a friedment that would tend to crass war continued in a continued to the content of th

t connecting a portion of the chands with the body of an automobile, and comprises the provision of means whereby the fields had in a slavays kept under a minimum tession to prevent the formation of stack portions. A further object is the provision of adjustable mechanism whereby the degree of application of the friction brake can be regulated as desired.

desired.

"TIRE ARMOR—L. C. Bornractivo and
M B Tarr, 5 Goodwin Road, Baltimore,
In protector for pensumate tires, the object
being to provide a simple construction
whereby sections of old outer easings or
to form a tire protecting tread of such
nature as to permit of resulty substitution of
different mechanisms where it becomes measured;
as construction where it becomes measured.

affire the action when it becomes a considerate action when it becomes a considerate and a considerate

surpose of the invention is the provision of simple as to construction and wiring arrange in policy attended to the character which man is policy attended to the character which in the character is a surpose of the whole of the character is provided in the character of the character which control as we remain a surpose of the whole of the treator. The invention is to provide, a defen which are the whole of the treator. The invention is to provide, a defen which are the provided by the control of the control of the provided by the control of the

the conventional type of axie and front the nervennent of the yabids. The curve wheel moont.

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ING.—W. A. SOUT, Chevenout, N. E., 4% operation of the validate in the smed and collect the provided of most wheely a displet and economically manufactured easiers provided to export and illustrate that is provided to export and illustrate the light. Another object related in the provided of manufactured easiers of the provided of the

form Humination of the plats may be a plat of the plats o

DOOR LAUFEL—6. D. WEZEN, 688 16th DOOR LAUFEL—6. D. WEZEN, 688 16th St., Hamtington, W. Yu. The principal object of the invention is to produce a laufe to the save the save that the save in connection with noise such white the save in connection with noise such white the product of the laufe which is got the door without in any year aestheliag the holding cealifies of the lastsh what had not be required to the characteristic of the lastsh when the save the save that the save the save the last white the save that the save the last the save that the save tha

Designs

Designs FOR A BOYTLE-L. Beauty, 155 Norman Ava, Brodlyn, R. Z.

DESIGN FOR PERGE GOODS—F. R. Z.

DESIGN FOR A TEXTULE FAREIC.

DESIGN FOR A TEXTULE FAREIC.

DESIGN FOR BOULT—G. P. MOST R. X.

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YOUR BOULT—G. P. MOST R. X.

PERGEN FOR BOULT—G. P. MOST R. X.

DESIGN FOR BOULT—G. P. MOST R. X.

DESIGN FOR BOULT—G. P. MOST R. X.

DESIGN FOR S. X. X.

DESIGN FOR THE YEAR FAREIC.

Good Driving Is Mostly

NICE STEERING

HOW TO PARK-HOW TO DRIVE-HOW TO ENJOY YOUR MOTOR CAR MORE

THIS ARTICLE (Continued on next page) SHOULD BE KEPT FOR REFERENCE



suggestions for the driving of moote cars and steep truths presented here are not intended to be presented as a sundanteed that engagences after the sundanteed that engagences of the few simple spice hand the applicanous of the few simple principles cortised here, in ordinary driving, will spoom like the driver to meet the emergency situations as they area.

ATTENTION TO THE JOB IN HAND IS first and most important. The good driver is never carcless.

TREATING TOUR GUEST IN YOUR CAR AS YOU WOULD IN YOUR HOME is the first point of driving abquistes. It is not only discourteous, but illegal, to risk lives Le interprecing some of the instructions and suggestions and discrements of State Laws must be considered

City Drioma Avoid sharp turns, either to right or left
When moving out from curb
do so in a gradual, dragonal line
When swinging in to curb, do so slowly and gradually
Tell the driver behind as much
as possible by the use of left arm 8

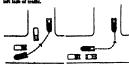
agnals

Do not depend upon his fol lowing your instructions Your signal does not give you the right to turn in front of him



read maked of terrang right Current section of turning right

When turning to right at street intersection get as close to right ourb as possible before turning When curning to left at street into



When approaching a street intersection, the Nico-Scener re down to a speed from which he can stop quickly to turning enoughd in a street where there is much traffic to normalize measury. In streets where there is to go no traffic, the "Nico-Scener" can easily turn in two prompts by following the meltiod shown in the diagram.





The Nice-Steerer never cuts in quickly after passing another machine. He realizes that the other car is moving also, and he allows ample time before gradually getting tack to his place on the right of the road.

The traffic lanes near the center of the street are for through traffic that is, cars that are not contemplating turning off to the right at the next several streets. The right hand lanes are for slow or parking, or right turning traffic.

The Nice-Steerer remembers that the rear wheels do not track the front wheels in turning He allows ample, but not too much, leeway for the rear wheels to miss curbs, posts, guards, traffic signals, building corners, etc.

As a rule it will be found a time and trouble saver to turn shout ly driving around the block rather than jamming traffic by turning in the street (This is not allowed, anyway, in many communities)

OTORISTS, motor clubs, much operators, garages, automotive manufacturers and dealers, learnance companies, policic chefs, dealers, learnance companies, policic chefs, dealers, companies, and diserbers, and classification of the companies of Canada, but in Europe and diserbers, the companies of Canada, but in Europe and diserbers have far abortled 17,447,970, 1992 of the book les, "Good During is Monity Nices 'tecning a control of the three chefs of distributions has been through recope of actual requests. Northing better middates the deep and wide control of actual requests. Northing better middates the deep and wide state of the companies of actual requests. Northing better middates the deep and wide state of the companies of actual requests. It is plan how targety nice exercing, so greatly in demand, depends upon ease of truring the form wheels.

inga in the steering procts.

In steering procts, as in transmissions, and on differentials, and on princess, and on ones, and on near wheels, and in frost wheels, Tunken dominance results from Timken extreme load capacity and reggedness, and from Timken at purability for the ware that must follow motion.

Tapered ROLLER BEARINGS

Another opportunity for Nice-Steering presents itself minutely in avading homps, ruts, track-crossings, etc. The steering wheel should not be moved too quetly the reaction is difficult to compensate for, and it imperis all neighboring carrs. So long as both frome thesets, or both raw wheels, do not have wheels, do not have the source of the the obstacle at the same time, the results are not bad

Street car tracks are at all times, but particularly in wet weather, dangerous to regionate. If the Noo-Steerer finds himself in the tracks, he lips his wheel first to one sale, then quickly to the other, and thereby acrapes the tree as little as possible, while maintaining complete control of the whicks.

Wat Streets

On wat streets the careful driver is even more careful

Sindding, once started, is hard to stop. Turning the wheels in the direction of the sind will help But this is designous linearized as usually there are curs, or chaldren, or capts, it has way.

THE ONLY SEID THAT YOU CAN CONTROL ABSOLUTELY IS THE ONE THAT DOESN'T START!

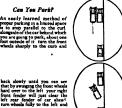
Slow, even turns slow, even stope, alow, even starts will avoid skids

Do not disengage your clutch!

Tire chains are of assistance on wet or muldy roads Clear vision, obtained by windshield wipers, is also ess

Can You Park?

An easily learned method of proper parking in a limited space is to stop parallel to the curl alongside of the car behind which you are going to park, about one toot outside of it turn the front wheels sharply to the curb and





back to proper position at curb This method, once you know positions at which extreme turns are to be made will park you at the proper distance from curb and other cars in one backward



Country Driving

While the 'Nice-Steerer keeps constantly on the alert even while driving through little-trafficked roads, the first thing to be learned for comfortable touring or long-dutance driving is a safe method of relaxation

The intermittent use of the hand throttle, on good, open roads, will reat the right foot and leg. The occasional use of the hand brake, besides being an excellent method of conserving both brakes, is also expedient and affe

At no time should both hands be free of the wheel Small moses, rats, and bumps will quickly disturb the equilibrium and throw the car in the ditch

Do not stop (to repair tires, etc.) in the middle of the road, near curves, or near the creas of hills.

Stones should be ramoved from the road, after using them to block the whoels

Starting the Motor

starting the Moler.

The spark should be retarded.

The clutch should be desengaged so that the hattery need not seekest your over the transmission gears.

It is often easier to start the motor by turning it over several tarses, with the air choked, before turning on the switch.





GOOD DRIVING IS MOSTLY NICE STEERING-(Continued from Page 271)

Gazoline Line and Carburstor

Dur in the gasoline line—and there will be dur despite the most careful filling—should be forced out by air.

sorted out by air.

Dirt or water in the vacuum tank may be removed through the cap-screw at the bottom.

Dirt or water in the float chamber of the carburetor may be

ber of the carburetor may be cleaned out by removing the screen container and blowing out both the container and screen.

The petcock at the bottom of the carburetor should be opened frequently to permit the accumu-lated water to run out.

1



Cooling System

Cooling Systems
Keep the rathere well filled.
Use soft water, if you can get it.
The realistor whould be consent
that realistory will be realistory to be realistory to the re

Steering Apparatus

The steering apparatus requires little attention, but should be inspected frequently to make sure that the front wheel are in line and that there is no play in either the wheels, the toe-rod, or remainder of the gearing

Tires should be kept properly inflated (See table of tire resource in this article.)

pressures in this article.)
And above all, the best assurance of easy steering is to own
a machine, the steering proofs of which are mounted on
timken Tapered Roller Bearings in such machinese the
steering mechanisms—instead of scraping and grinding—turn
easily on the rollers of Timken Bearings.



Battery

At least once in two weeks, and oftener in hot weather, the battery should be inspected to see that distilled water covers the plates in each cell by 1/2 inch. If the hydrometer shows a reading of less than 1250, the battery should be recharged. A reading of 1280 means that the battery is fully charged.

Dry the top of the battery after filling. Keepterminals clean.

An application of vascline axis

100

S. Wally Com

Spark Plugs

Clean, heavy-hitting spark pluga delight the "Nice-Steerer" Pluga can best be cleaned by seaking in kerosene and scraping with a dull knife.

The points of the spark plug should be set spart about the thickness of a worn dime.

Lights

Both head and tail lights should be inspected before starting out. It is a good plan to carry an extra headlight bulb, tail light bulb, and fuse, for lights may burn out any time.

To avoid dan-ger to yourself, as well as other as well as other machines, your lights should be focused so that they do not throw their rays above four feet from the ground at any

The "Nice-Secret" uses his dimmers when meeting other machines, for many lenses that are legal throw a blinding glare when the bright lights



Tire Deamater
334 inches
4 inches
434 inches
5 inches

Cord tires may be run some-what softer according to tire men, without excessive injury. The spare tire should be pro-Wheel alignment front and sould be checked regularly

Inspect tires frequently and fill up holes and cuts with tire filler.



Tire Chains

If properly applied, chains are less harmful to the tire. The hooks, when laying the chain over the top of the tare, should be toward the rear The chains should be just tight nough to allow them to creep a the tires.

Innurance

Because not all drivers are "Nice-Streeters," and if you are contemplating buying automobile magrance, be sure you are covered before taking the car out of the garage. Not only may "temporrow" be too late—it naver arrives.

If You Have Never Driven a Car

This is the way to start your car after starting your m (1) Disengage your clutch, put the gear-shift lever in low (first) speed position, and engage the clutch slowly as you depress the accelerator

(2) After the car has guined some momentum disengage the clutch, move the gear-shift lever from low (first) to inter-mediate (second) speed and engage the clutch gradually, as you slowly depress the accelerator

(3) When the momentum is between from 15 to 20 miles an hour disengage the clutch. Move the gear-shift lever from intermediate (second) speed into high (third) speed Engage the clutch (This does not apply to cars with planetary type transmission).

Maintenance of Timben Bearings

The greatest advantage of Timken Tapered Roller Bearings is the adjustable feature, or "take-up," as it is commonly called. Many different methods are used in mounting Tinken Tapered Roller Boernags in front and rear whesis, differential, principal and a state of the stat

assembly and up closer together. Wear, Bazariot. To take up the war on wheel hearing. Wear, Bazariot. To take up the war on wheel hearing until the second property of the second until the wheel heads. Nata revolve wheel to be save all until the wheel heads. Nata revolve wheel to be save all until the wheel heads. A war to a point where wheel is from concluded to one-half of a farm to a point where wheel is although the whole in the wheel is alknown. Look the adjusting not at that point. Do not matake wear on steering pivot bolts or bushings for july in wheel bearings.

NOT OR SOREW ADJUSTMENT TO take up the wear at rear sale and transmission, where series or not adjustment is provided, the nut or series whould be drawn up to a point where it starts to hand. It should then be backed off from one-thard to one-half a turn and locked at that point.

concurse to one-near a turn and located at that point.

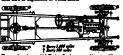
Same Appurpagars, To take up were where she an adjusments are provided, remove the boils that hold the carrier
in place. Take out one of the thinnest shame, This is
usually all that is required. Next put bothe back in place.

Wonst Start Appurpagar. The following inseructions
should be observed on adjustment of worm shaft bearings
on 1, 154, 2, 245, 5, and 394 out trushs.

The worm shaft should be no adjusted as to make allowance for expansion from heat generated in service. On most trucks the adjustment is taken up on the front and of the worm housing by serving on a sleeve which forces the cup farther over the cose and roller assembly. One noted on this sleeve equals about 2007

Adjustments should be made on various crucks as follows:
On I, 1/4, 2, 2/4 ton; acrew the stever in until the end play is out of the worm shafe. Back of five to them noticing which cause in the country of the country

and play. The reason for this and play is, as noted above, to take cure of separates of worm white.



Ber of the print should be been been by the best in the best in

LUBARIZATION OF THE BRABINGS Any light grosse or heavy oil will serve as a intercent for Timken Roller Bearings, if it is positively free from said. The lubricant should be placed in the grosse cups, where they are provided.

they are provided. In the case of the provided provided in the case of the provided provided



THE basic design of Timben Tapered Reliev Bearings in labor-ently adapted for Daal-Duty—the shifty to carry not only radial loads, but all thrust loads, and resultant loads at

loads, and resultant loads at all speeds.

This simplifies mountings, permits smaller and lighter housings and thus in segurates an entire series of refinements

'I M K Tapered ROLLER BEARINGS

You will Know a "Nice-Steerer" by

His keeping to the right of the road, particularly on curves all over the creats of hills.

and over the creats of hills.

His extensive and intelligent use of arm signals.

His extensive and intelligent use of arm signals.

His evodance of all obsercies, however small, without

the same of handling.

His extensive and substitution of the same signals.

His controlling.

His extensive has Park Parking signs.

His controllenses in hugging the right of the road when

you blow your regions to be let by.

His procection of his motors; his use of second and first speech.

His gloraction are of foct and hand brakes on long grades or

His alternate use of foct and hand brakes on long grades or

is energiancias. His naver construit, the naver construit, and the naver construit na

ilind crossing.

His consideration of others by keeping his muffer closed a cidea and reason.

His consideration of others by keeping his multier closed a cities and towns. His further consideration of others by ringing the door-hall attend of libering has hepe repeatedly. His properly edjusted, reserving application. His properly edjusted, reserving application. His asso of the brakes HEFOILE he gots to the coartie. His coal of the brakes HEFOILE he gots to the coartie. His coalcance hast, having som the child, he (per the hallest art properties.)

The Scientific American Digest

A review of the technical and trade press, consisting of abstracts from leading articles announcing the newest developments in industry and engineering

Band rightness to the sources from which these obstracts and quotations are made follow such abburd, the summain ordering respectively to the volume, number, and pages occupied by the original orders in order that those who what for further data may right to the originals. Other disease oppose in Electrical Notes, Barnes of the Chemist, Motor-Drison Commercial Voicies, and other departments.

Civil Engineering

weight of of tome. They are supplied wind any extens hasted. On the hitfall run from Newandto London an everage appeal of the supplied wind and the suppli

signs for new pavements should provide for strengthened edges. The new design, based on these tests, therefore calls for a mis-linch edge thickness, tapering to six inches at two feet from the edge rather than taper-ing in the opposite direction. The edge is the opposite direction. The edge is quarter-lich round har—disheson Singinger and Contractor, S. 6, pp. 37-43.

stilledow material while by combination with the See lines relocated in satting will form a consulting and a companion of the control of the



These groups of stockholders illustrate the rapid growth in ownership of the Bell System

A Community of Owners Nation-wide

"What is behind it?" These appeals to sound business judgquestions are asked in apprais- ment and a trained sense of ing the soundness of a business values. and in determining its aims.

The American Telephone and Telegraph Company is owned by more than 270,000 people living in every state m the Union. Could the stockholders of the Bell System be gathered to one place, they would equal the population of a city about the size of Providence or Denver.

They constitute a representative cross-section of American System, none has its shares discitizenship. Among them, of course, are bankers and men of truest sense it is owned by those large affairs; for the idea of it serves.

"Who owns the company?" ownership in the Bell System

In this community of owners are the average man and woman. the storekeeper, the clerk, the salesman, the professional man. the farmer and the housewifeusers of the telephone who with their savings have purchased a share in its ownership. The average individual holding is but twenty-six shares.

No mstitution is more popularly owned than the Bell tributed more widely. In the



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Charles to the control of the pronunciation of Reactota, the spelling of a puzzling word, the location of Eathernia the meaning of soviet, realton vitamina, st. It is Supreme Authority. WEBSTER'S NEW INTERNATIONAL DICTIONARY contains an accurate, final angiver 407,000 mms. 8100 mm. 600

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The Foreman can read between the lines



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for engacintists of a large growth of the industry due to the fundamental wealth of the Cuech untion.—American Machinist, 19 th, pp. 50-50.

Ballan-wood for Refrigurators—Micohlighter than orei, and composed of thisrelates. This wood is adapted from the formation. This wood is adapted from the formation than wood in adapted from the formation of the formation of the is used in cold stronger plants, notigenutes car and in beautionable principation. In the latter own below treed from the formation of the formation of the formation of the latter own below treed from the formation of the formation of the formation of the latter own below treed from the formation of the formation of the formation of the latter of the formation of the formation of the latter of the formation of the formation of the latter of the formation of the formation of the latter of the formation of the formatio

Predictor Gas is now being used for bursing refractory briefs. Collisions asgenerative that are useessory for successive generative that are useessory for successive or gas. The compartment kills, freed with producer gas, is best adapted for general tic control of the control of the control of the advantage that a moch larger quantity of int can be introduced and burned in the advantage that a moch larger quantity of int can be introduced and burned in the produced best in all parts in the advantage possible time. In the continuous lifts, temperatures up to 1400 degrees Contigrade are ("waste Kong, 6.7, pp. 708-907.")

year, especially in the latter half, the use of pulseristic for equipment for boiler plant operation has taken rapid strikes and many properties and the properties of the pulsers of the pulsers of a large number of central power stations where the pulsers of th

Testing Flantish Bailes Staybests Escribility—Normation of testing that detriculty—Normation of testing that decribely satisfactory whose danger to human like is assured. The norm subto of largocitive statement of the satisfactory whose between the satisfactory whose staybests locally satisfactory whose staybests and locally satisfactory whose satisfactory whose the small rod consocial in series with a lateing contact at the inner and of the hole with a small rod consocial in series with a latelation of the satisfactory whose satisfactory in the satisfactory whose satisfactory whose indicates the satisfactory whose satisfa

A Great New Development in the Attended True changes The Combination of the Combination o

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Sixty Million Dollars Worth of Union Station

Yellow Strand Wire Rope, as usual, is very much in avidence. The identifying strend of yellow may be hid-den under greeze and dirt or its yellow paint may have vanished long ago. Still this powerful rope carries on, doing its bit in the aste, economical handling of tons upon tone of material daily

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Spray Engineering Co.

SPRACO

Now You Can least to the second a fraction of the fact of of the f

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Temporary Decility of Sheets of Sill-

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whose Trade Ates., 73 4, pp. 107 10

A New Method of Impeculing Steel by
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ties as strougth, hardness and britteness. An Machistri, 10.5, p. 148.

Machistri, 10.5, p. 148.

Machistri, 10.5, p. 148.

Machine Shop the soons very definite conditions. The machine strong the strong very definite conditions. The relationship is the same of special machinery, with a strong st

Proved by Test Not by Argument



nese illustrations are reproduced from photographs of box to made under the supervision of the United States Department of Agriculture at the Forest Products Laboratories.

WOOD boxes and crates are recognized as the any other material and in general use would have failed in this diagonal compression test long before the nailed wooden box did at 957 pounds pressure

But the Pioneer Wirebound Box, using less lumber and weighing one-half as much, withstood a pressure of 1783 pounds

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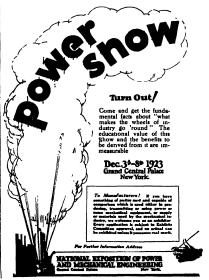
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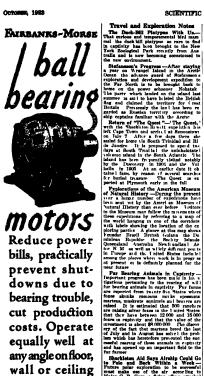
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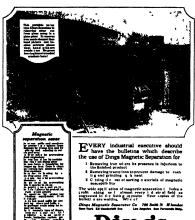




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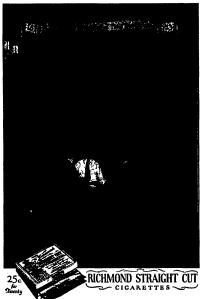
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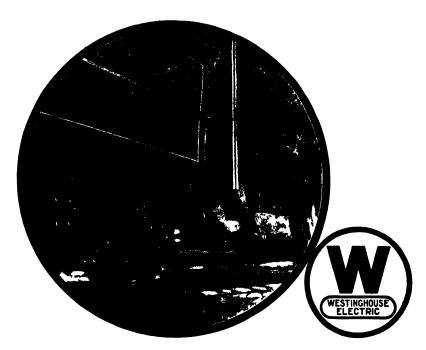
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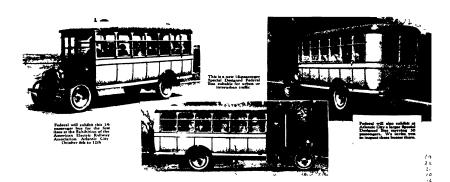
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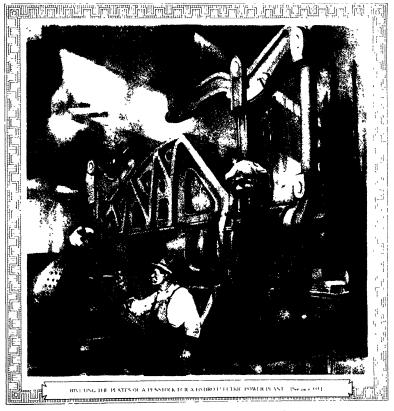


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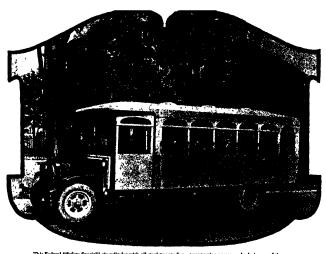
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With the Editors

THE fiftieth anniversary of that indis-THE fitteth anniversary of that indis-pensable tool of modern business— the typewriter—was recently celebrated. At the time we carried a full page of type-writer photographs, selected with a view to depicting the progress of this most use-ful invention. And now we have some-thing more to add to our brief review of typewriter evolution. From the book en typewriter evolution. From the book en titled "History of the Typewriter," by Marea, we learn that "during the years 1847 to 1803, Airred E. Beach, the editor of the Schwitter American, invented a number of machines. The most number of machines. The most noticeable feature which will strike the typist of today is the key-stem passing typist of today is the key-stem passing through the bridge, the bell-crank lever pulling the connecting wire, and the piv oting of the type-levers. With this illustra-tion before him the operator might very well wonder wherein the inventions of the past thirty years have advanced the essen-tial theory of the typewriter But Reach's machine was not intended as a writer pure and simple. It was used to embess a narrow paper tupe. This tape fed through the center of the machine, and the type-bars themselves worked in pairs like a pair of themselves worked in pairs like a pair of tongs. When a key was depressed, the lower bar rose, and the upper har de-scanded, and gripped the paper between them. On one bar the letter was in relief, and in the other it was sunk, so that the and in the other it was sunk, so that the paper was forced into the sunken letter by the pressure of the one in relief. The type-bars all converged to a common even ter, and the paper was fed forward by an independent clockwork mechanism, the e-capement of which was controlled by a cori, which, passing beneath the type-bars depressed, and allowed the trail of clockdepressed, and allowed the train of circumork to advance the paper the space required to emboss the next letter. Thus we have a third state in the evolution of the machine, namely, the equivalent of what we now call the universal bar

SO once more we rise to bow in acknowl-edgment. In the past, as in the present and the future, we have not always been satisfied to serve merely as a chronicler of satisfied to serve incress an a coronicer of the advance of science. At times we have gone quite beyond the bounds of journal ism and have taken a hand in the development of a given invention, either by con tributing our ideas and suggestions to the triouting our ideas and suggestions to the workers in that particular field, or by conducting rigid investigations and studies which have resulted in helpful conclusions, we have every reason to believe.

FOR the present, our psychic investiga-tion and our Abrams electronic reactions a non and our horans electronic reactions investigation are engaging our post-jour-nalistic efforts, so to speak. In this issue will be found an interesting account of how Dr Geley, the well-known Director of the Institut Metapsychique International of Paris, obtained the famous Franck Kluski wax molds which have attracted so much rat motia which have attracted so much statusion in and out of payelle circles. The original manuscript, written by Irst Goley in French, his native tompos, has considered to the control of the control

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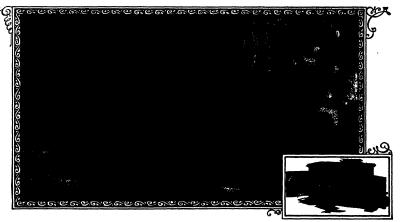
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N this lauve, too, there appears the re-Electronic Reactions of Abrums method of diagnosis. This first test was of the most elementary character, and we were pre-pared to follow it up immediately with others surrounded by more difficult condi-tions. Yet, singularly enough, the elec-tronic reactions diagnostician in this instance, who claims to use the genuine stance, who claims to use the genuine Abrams methods and who certainly makes use of the Abrams "rate" charts and other Abrams technique, all but falled com-pletely in his diagnosis of pure germ cul-tures. The report makes unusually interesting reading, but it is well to caution the reader that this test must not be considered conclusive. Far more work must yet be done before we can begin to formu-late an opinion as regards the merits of the electronic reactions of Abrums diag-

WE are fortunate in being able to pre-sent in this issue two articles on topics of the first importance, which have topics of the first importance, which have been written for us by two of the best-known Admirals of our Navy. They are timely, moreover, Innamuch as the anni-versary of Theodore Roosewitz is brithday has been set apart this year as Navy. Day. and everyone knows that the Navy has never possessed a stauncher and more halpful friend than the great man whom it thus honors. The tribute of Admiral Sims to Rossevelt's influence in building up the Navy both in its material and personnel, is particularly valuable because of the fact that the Admiral was Naval Aide to the President during the time when notable reforms in tarket practice ship design, and so forth, were made and he speaks with intimate knowledge of the facis. It is quite unnecessary to say any-thing here of Admiral Sims record. He ting acre of Admiral Sides record the was chosen to represent the Navy abroad during the World War, and the great serv-lees he rendered in this difficult position are a matter of record

REAR ADMIRAL GLEAVES is snother R mival officer who stood out consideration only because of his war services, for it was be who, with headquarters at Hoboken, had charge of the great and difficult task of putting two million of our American soldiers across the seas, and bringing There can be no finer tribute to the Ad miral than the remarkably successful way Admiral, as our readers will note, has a facile literary pen, and among his best works is a life of Captain Lawrence of the Chesapeake, which should be read by every student of American naval history

ROM Sir Oliver Lodge's own p I learn something of the wonders of the atom, with the little universe of its own, in the article entitled "Within the Atom" Sir Oliver has the happy faculty of human-izing science. In this instance he takes the otherwise intricate subject of electrons and protons and converts it into a highly interesting story which may be read by layman and physicist alike. We hope to have other articles from the pen of this great scientist, who, contrary to the general rule knows how to express himself in a style that is an entertaining as it is understandable to everyone.



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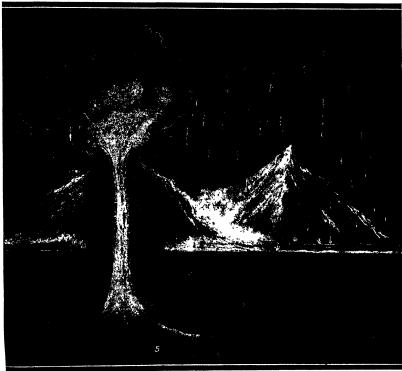
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SCIENTIFIC AMERICAN

THE MONTHLY JOURNAL OF PRACTICAL INFORMATION

NEW YORK, NOVEMBER, 1923



The mechanics of a voiceme: The lava deposited by a former cruption is shown at (1), and the cripinal strata at (2). Water sinking down to the fire reservoir (2) makes the steam of an cruption. (4) is reck which, although very bot, is not moliten because of the pressure shows it. At (5) the repeater has been released owing the steam of an cruption. (4) is reck which, although very because molite, and out it guestia—(50 pergo 344 and 345)

The Drama of Disputed Documents

Some of the Tests by Which the Expert Reveals the Forgery for What It Is

By Edward H. Smuth



MAY, 1871, was begun, in the Court of Common. Pleus of Lendon, the greatest of Common Pleus of Lendon, the greatest of the Court of the purpose can browling failing and forager. The action had been brought in the purpose of disposessing the trainers of Sir Alfred Tichlorme, minor, in court of the purpose of disposessing the relation of the Court of the Purpose of the Court of the

trial of this civil action and the resulting criminal protrai of this civil action and the resulting criminal pre-secution of the claimant required all of three years, consulted enormous sums and brought the principals world-wide notoriety. It put upon the musty court records of the day one of the strange and abiding mances of crime

Having been crossed in love through an unrequited passion for his cousin, the young heir to the baronetcy of Tichborne set out from England in 1853 for the antipodes. His ship, the "Bella," touched at Rio and put down to sea from there, to return no more Tichborne and all his mates of the voyage went down to the dark ports of the missing, and in due time the British courts in chancery determined his death and fixed the suc-

in chancery occurrentment mis ocatin and nived the suc-cession of the fifte and evides.

Only the young noblemans mother clung with plain-tive pertinacity to a belief,
a hope, that he might have survived Sens and the fates of men are never too cruel for the wrung maternal heart Lady Tichborne con heart Lady Tichborne con-tinued to search for her lost son, mainly by asking ac-quaintances bound for Aus-tralia and New Zenland to seek for news of him 1865 a man named Cubitt established a "Missing Friends Office" in Sidney and announced this fact in the London Times Cubitt som heard from Lady Tichhome and undertook to find her son In the first months of 1806 she began to receive letters from a man who set himself up as the missing Roger and recited some of his adventures since leaving London in 1858. He told of the ships reck, his providen rival in Australia, his trials

and his wanderings. And though he made many mis-takes and pulpable blunders, the bereavel mother de-clined to see any fault in him and accepted him un-

eservedly as her vanished son In response to her urgings the Tichborne claimant went to London in 1806 and began preparing for an action against the trustees under the old baroner's will, made when the son was supposed to be dead. He sp more than five years in these preparations, not be-ginning his suit until 1871. How he spent this time

veloped at the two trials. The claimant was in reality the son of a Wapping butcher, by name Arthur Orton. He had gone to Australia the year after young Tichborne had set out on train the veer after young removine man set out on his futal vonge. In the antipodes Orton had suffered every manner of reverse and impoverishment. Finally, more in less than carnest he began to pass himself off as the Th aborne helr. Later came the Idea of making as the Thiborne helt. Later came the idea of making a Lruic pirt indem and trying to win the estate and title. Orion was a gross-looking fellow of common education. The man he want trying to Impersonate was a British gentleman who had been primarily educated in France and knew his French better than his English. These heavy obstacles seemed not to dannt Orion at

These heavy obstacles assented not to daunt Orion at all He determined to make himself act, talk and write like a gentleman. By some means he got hold of samples of the real Tichborne heir a bundwriting and set himself the task of learning to indirate it. His letters to Lady Tichborne reveal the extent of his

letters to Lady Tichborne reveal the extent of his success and the depth of his failure. After what must have been productous labor unre-leuting discipline and unremitting devotion this com-mon and practically unlettered fellow was able to re-produce the handwriting of a tenderly reared and over

sensitive young lord with almost uncanny fidelity Orton get not only the obvious peculiarities of the Tichborne handwriting but managed by some strange adaptiveness of mentality to achieve what must be recognised as the or mentantly to sensew what must be recognised as the nervous and psychological characteristics, a feat which hands riting technicians everywhere will recognise as next to impossible The false helr even learned to misspell just such words as the young baronet wrote smiles, because his principal education had been in French, no doubt. But what Arthur Orton, the cockingrench, he count, but what Arthur Orton, the cocking, could not do was to follow the phrasing characteristic of the man into whose life and identity he was trying to substitute himself. Tichborne habitually thought in French and translated into English when writing letters, so that his opistles teemed with badly disguised French idioma. These were absent from the Orton letters and it was by this deficiency that the experts of that day fastened the fraud upon him

The man who conceived and very nearly carried to triumph this great impersonation, this astounding and triming this great impersonation, this automating and injudent imposture, was eventually sent to prison as a fraud and forger. Even after his consistion there were many thousands, among them persons who had known the young Tichhorno well, who persisted in the bellef that Orics was the tree heir and a sorely

verse as translations of Third Century Gaelic or the verse as translations of Third Century Gasele or the creation of a Fitteenth Century Monk. Indeed, the main trend of fuisitying and forging runs after from the siming and perilous fields of art. In consonance with the modern teste, it finds its way among the marts and the modern tasts, it finds its way among the marts allo places of business. As a result we have now more to do with false wills, bonds, legal conveyances and scount hooks. An enormous total of money is got every year by such devices—tens of millions, past question. And were it not for the perfection to which the modern And were it not on the perrection to which the modern technician in authenticity has carried his work and his art, the loot of the forgers would assuredly be the times as great. Here is where the modern contest begins between the expert in hand and typewriting and the criminal who makes this field the scene of his artifices. The problem of instrument falsification and detection

The problem of natrument fallsfiestion and detection rear inchannelially upon four miterials—passer, ink, rear inchannelially upon four miterials—passer, ink, delicate instruments for measuring loops and porthoos, various chemicals used in analysis, reagents for tearlies papers, writing mechines, handwriting, characteristics, old manuscripts and the materials with which they were written are the secondary forces which figure in



Enlarged typewritten words taken from an anonymous letter and juxtaposed to the same words written on the suspected typewriter. Note the absolute uniformity

wronged man. Not until a good many years later, when poverty induced him to write his full confession for a London publication, was the doubt entirely cleared.

for a London publication, was the doubt entirely cientred. This world famous case may well serve as an introduction to the subject of the evergreen content between the faisifiers of documents and the experts in questioned instruments of every kind, surely one of the most absorbing matrices of wits between the man of society and the man of crime.

and the man of crime.

Falsification of various legal instruments is, of course, extremely old. Erasures have been found in the Nilotic paper; which apparently admit of no interpretation save that of fraud. The even earlier cuneiform writings on the clays of Rabylon were so carefully protected by special clay envelopes, which would have had to be broken before the writing on the inner tablet had to be broken before the writing on the laner table-could have been changed, and an esto-northy provided with seals and the signatures of witnesses as to make the seals are the signatures of witnesses as to make the seals of the signature of the seals of the force and his methods. Classic and early Ohristian manuscripts, particularly those of a religious chearacter, have not looked been altered and defined again and again. Troby fraud and histhiculton scient do every human

Today frank and falsification extend to every human article of value on interest (toget works of art, old fraudulent liceushells, forged antographs and sporting original manageripts are being offered and old swery day. Literary impostures are common as alt, though the company of the common and the company of the common and the company of the common and the company of the company of the common and the company of the company

Now, alas, no one bothers to palm off beautifully de

the matter the matter

Ink is the stuff of prime interest. In former times all ink was gallate of Iron, a substance which turned black slowly, after shorter or longer exposure to the air Gallate of iron is still the basts of all commercial inks now used in the United States, but today more and States, but today more same more auxiliary substances are being used in combina-tion with the iron base, for the purpose of giving the writing an immediate "good color" What happens to the iron of the ink after some exposure to the air is exactly exposure to the air is exactly what befalls a steel blade when air and moisture strike it — oxidation. Weathering deposits a red oxide of Iron

deposits a red oxide of Iren
on the seed It turns the
guitate of fron into Sacci
turns blacker as they grow
older, while the auxiliary
colors gradually fade. There is, however, a limit sup
the process of blackening. At the end of about eight
years the oxidation is complete and no further change is

sheer with the complete and no interest causes as the control of t This matter of the slow exidation of commercial inks

account book had been speedily and fictively prepared, just before the breakup. Such practices are, of course, overy common. They are one of the principal bases of the orims of fraudlent bankruptcy which, according to the Mational Association of Credit Men, costs the lesslers and manufacturers of the country

nount 400 millions a year in losses.

There was added reason for suspicion in this sole book of accounts. It was to be noted that sil the entries book of accounts. If was to be noted that all the entries in it were written in the same hix and by the same hand. Moreover, there was so slight variation in the anotherities of the hookkeeper that the work had the appearance of having been written at one sitting, if writes praching a like at any two times. Mood, the state of health, the weather, the position while written—the psychological state of the writes—the writes—the psychological state of the writes—the writes—the psychological state of the writes—the writes—the psychological state of the writes—the writes—the psychological state of the writes—the writes—

of the bunkrupts would likely be confirmed. The book was, accordingly, taken to that veteran examiner of questioned documents, Mr. David N Carvalho, who has been the chief American exponent of the art for fifty years and official expert of the district attorneys soffice for most of that long turn of service. Mr Carvalho tested the ink on the first page of the book and the ink of the last En found that the oxidation had preof the last He found that the oxidation had pro-pressed almost equally in both samples. Also, he dis-covered from the degree of oxidation, that the writing! had all been done within a period of ten or fifteen days and not more than 20 to 80 days before the bankruptcy Ergo, the entries had all been written at about the argo, tow curries Bad all been written at about the same time, they had not been made on the dates indicated and they were, therefore, fictitious. It was later dis-covered that the book had not been bought until sever-ional active the date of the first entries. The fraud was thus established.

months after the date of the first entries. The fraud was thus satisfiableadous are coming to interest the handwriting technicas more and more every year, as the practice of "decloring" accounts and failstring entries spreads over the country.

The matter of ink removers is one I discussed some months ago in connection with check forgery and nitre that of the question here. All links, being comparatively simple chemical compounds, may be broken down by chemical means. The exception is made of anilize links may, however, be instantly removed with a little links may however, be instantly removed with a little links may however, be interested and declaration of the control of the common acids well counts, but they do not resist a combination and the control of the control of the remover which can be longit in any drug or stationery store makes swift moved of such precedules and control of the con

ock of such pretentious combinations.

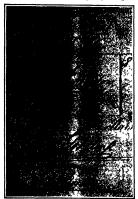
These commercial ink removers are, as everyone

These commercial ink re knows, contained in two little bottles and ordinarily labeled No. 1 and No. 2, in-dicating the order of their application No. 1 is usually a slightly red liquid, a 20 per cent solution of section acid. No 2 clear liquid is a 10 per cent solution of chlorinate of lime or sods. The chlorinate, lime or soda. The chlorinate, contacting with the acid, gives off chlorine gas, a very effective bleach of almost anything. This gas imme-diately changes the black oxide of iron in the ink into white oxide and the writing disappears, as the bleach also these the other colors also takes the other colors from the writing fluid. Ex-

of course, with stronger re-movers that this, but the same principle underlies then all. The fact worth remembering is that anthing is actually removed by this process. The chemicals which sive the jak its black color are simply whitmed and made invisible. They remain in and on the paper There-

inal, unless he is a man of technical educa tion, usually falls to understand this and goes blithely ahead with his liquid deletives. Then his work comes under the eye of the expert. A simple and easy application of other chemicals, such as the hydro-sulfuret of amnositum, to mention only one, immediately brings the "removed" writing to sight—in deep yellow lines instead of black. The white iron oxide has been conthe "removed" writing to signi-in every years the instead of black. The white iron oxide has been converted into a suitate and is as clearly legible as ever This test has often been made in court, in the prosence of juries, with startling effect and usually sad results to the perpetrators of fraud

It frequently happens that men who plan frauds of this kind try to anticipate the expert by causing the



Genuine signatures of the late George P. Gordon, its, that he used the pothook at the end only once and the scroll underneath when he thought of it

original documents to be written in aniline inks, which are then removed with the tongue or a wet stronge Naturally, these inks and this form of removing leaves little or no trace and the writing cannot be restored chemically But the expert has still a method of cit cumventing the crook. All paper of modern type is calendered, which means that it is ironed or finished between hot rollers. If a drop of water or fluid chemical touches the paper thereafter, the ironed surface is dis-turbed and softened. Even if a long period of time

property Money, goods, wealth—these are, of course, the root of his motivation, but often enough the criminal must use murder as a weapon to his end. Most older readers will remember the celebrated Patrick murder trial and cannot have quite forgotten the great part played in it by the problems of forgery and handwriting.

According to the case laid down by the prosecution, Albert T Patrick, an inconspicuous New York Inwyer, came to be slightly acquainted with William Marsh Rice, a multi-millionaire capitalist who had come from Texas, and conspired with Rice's valet, Jones, to draw a false will, execute some checks in Putrick's favor and write Patrick a number of letters, which could be produced to show that Rice and Patrick were intimate friends. Patrick knew enough to have the letters and the will written on a typewriter in Rice's apartment by Jones, who also did his master's secretarial work. He then had Jones study Rice's handwriting so that he might be able to forge the old millionaire's signature to the

various instruments.

Probably there was no original intention to murd Rice, who was 81 years old, very feeble and appeared likely to die at any moment. But extraneous events forced the conspirators to desperate action. The old man was first weakened with doses of mercurial pills and finally killed with chloroform, which was placed over his face in a towel cone while he siept

over his face in a tower come while he stept
Jones, however, made two mistrikes. In writing out
one of the large checks made papable to Patrick ho
wrote the lawyer's name "Abert Instead of 'Albert'
This blunder was found by the lank teller who refused to sign the theck and tried to communicate with Rice. This silp caused the interruption of the plan for cremating the body and thus destroying the evidence of

muriter
The second mistake made by Jones is one common to forgers or signatures on wills and other instruments, Jones had vidently not one of Rives genuine signatures and begun tracing it or copying the—probably the writes his signatures and begun tracing it or copying the—probably the writes his signatures not begun tracing it for expensive years and the writes his signatures for the circumstances on the letters to Patrick, the checks, the request for the cremation and the will first if were of equal bigness and deculy similarity. The forgery was supararent deculy similarity. The forger years supararent common states as witness, Patrick in the shadow of came a state, a witness. Patrick is just the shadow of came a state, a witness.

came a state s witness. Patrick has in the shadow of the electric chair for four years and was finally par-doned, largely because of the uncertainty of medical

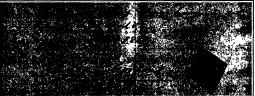
testimony
Typewriting presents special problems to the concouler and the expert. Almost everyone knows, by this
time, that writing machines have their individualities
like human beings. No two machines, even though they be of the same make and model and operated by the out work that does not show clear distinctions, one place from the other. Even if some of the type keys are changed after a fraudulent document has been written on a machine this fact can be developed and proved Or if all the keys are removed and new ones substituted throughout the expert is likely to find pecu

liarities due to the roller or some mechanical imperfec-tion If he does this, he can also find out where the old keys were removed and the only safety for the criminal is to break up the machine completely and dispose of it In some sure and searct way All these facts are more less widely known among

sharpers of every stripe What is much less familfar to the public and the crook is the fact that type writing has its nervous and psychological, as well as its physical peculiarities. The expert can tell whether a

piece of 1) ping has been done ouch system" or the visual





The last clause of the spurious will of George P. Gordon, showing the spurious signature with the pot-hook at the end and the uncertain, obviously copied scroll underneath

elapses, this blendah remains. The expert finds erasures of this type by substitute the entire writing to frames of toline. Wherever a paper has been so erased the toline funes exists it to turn thus and to begin to these the previously invisible pen wounds or cuts in the paper poin. Note him sport are then lightly dusted with lamp black and the original writing may then be clearly seen.

It must not be supposed that the criminal who falsi-fice handwriting confines himself to offenses against

Each operator uses a machine a little differently, spaces individually uses various keys for special purposes, etc. Mr. C. D. West, the veteran investigator of the National Association of Credit Men ran down one of the most celebrated of credit swindlers through peculurities in typing. This man was in the habit of opening ms wear and specialty shops in various towns and (Continued on page 369)

9

Largest seismograph in this country, installed in New York City This is a close-up view of one of the

OLCANOES and earthquakes afford spec-OLCANORS and earthquakes afford spec-tualist and impressive manifestations of the titanic subtranseum forces which are till at work on the fashioning of our globe the cultedysms and upbeavals ac-stored the most terrible disasters which have befallen mankind 'Custatyuphe after contactrophe of this nature

municial causiropie are catastropie of this nature has marked the course of history, but never, perhaps, one so great as that which at noon on September 1 hald in ruins two of the principal cities of Japan and took a toll of about 200,000 lives. And as the Japanese people, like all peoples before them similarly stricken, turn quickly to the work of reconstruction, we wonder at the exhibition at once of man's feebleness and his greatness e face of these appalling forces of nature.

Mastry over the effects of these natural forces comes only through a through understanding of their operations. Unfortunativity, our views concerning the ultimate the second of the sec Mastery over the effects of these natural forces comes truct, has been found inadequate fully to explain the origin of the forces which build mountains and cause

General Structure of the Earth Several lines of evidence point to the fact that the earth is solid through out, and about as rigid as steel. On the other hand, observations in mines and deep borings leave no doubt but that at comparatively moderate depths. within the earth the temperature must exceed the melting points of all known substances. However, most substances, and probably all ordinary rocks, ex-pand in passing from the solid to the pand in passing from the solid to the liquid condition. For this reason liquefaction is opposed by pressure, and a much higher temperature is necessar; to melt a rock subjected to great pressure. Hence the tremendous and ever increasing pressures within the earth keep the material in the solid state. At the same time, these

solid state At the same time, these very pressures some exceed the crush ling strength of any known substance ling strength of any known substance. So the same substance is not supported by the substance of the

This part of the earth grades above into the outer brittle shell, where an increasing stress will in time

Earthquakes and Volcanoes

The Mechanics of These Titanic Subterranean Forces and Their Destructive Careers

By Edgar W. Woolard

Division of Sciemological Investigations, U. S. Weather Bureau

result in the fracturing of the rock and the bodity dis-placement of blocks of the saurily crust along the break, properties of the saurily crust along the break, to the bear upon the crust of the earth have been, and are still belag, relieved by constant slow movements up and down, by warphar, folding, faulting and dislocation, of down, by warphar, folding, faulting and dislocation, of within the earth. Hork stream, the structure and con-tents of which prove them to have been originally hort scattal sheets of sediments deposited at the bottom of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the contract of the con-tract of the contract of the the ocean, are now found at all elevations up to the tops of high mountains, shurply folded, and traversed by extensive faults, often hundreds of miles in length, slong same of which thousands of feet of slipping, as taken place. Great belts of weekness have been developed in the crust along which the major deformations. have taken place.

Volcanic and Scientic Phenomena

Earthquakes and volcances are inevitable accompani-ents of the above processes of earth deformation. The immediate character of earthquakes has long been established as a form of undustory motion in the more or less elastic rocky crust of the earth, originated by some sudden inpulse or disturbance in the substance of the earth, much as a bowl of jelly might be set in of the earth, much as a bowl of jelly might be set in vibration by a smart tap on the side of the vessel. In many cases, as in the California earthquake of 1900, the shock is accompanied by visible fractures and displace-ments of the solid rock, the disturbance reaches its climax close by the fracture. In other cases no actual faulting is visible at the surface, the whole of the stip-faulting is visible at the surface, the whole of the stipmutting is visine at the surface, the whole of the sup-plug having taken place some nitle below the surface. However, we have here only the beginning of the story, for we need to know what causes the fracture that give rise to the quake, and this problem has not yet been

fully salved.

Nimilarly the investigation of vulcentism has raised a wide range of problems, most of which still await solution. Just always we do not know vicenaes ergul, we do not know the salvest solution and the vulcenaes ergul, we do not know the salvest solution of the content of the varieties of the varieties of the content of the varieties of the varieties of the varieties of the content of the varieties of the content of the varieties of the content of the varieties o

cipal existing mountain chains were born. They occur in great bands, marking the lines of westness in the which bound the high coeanic beam-regions of recent, which bound the high oceanic beam-regions of recent, or in some cases still continuing, mountain growth. There croks are beld by friction and pressure under increasing stresses until they yield. Slipping suddenly, they com-mulates an elastic shock or for to the cruse of the municate an elastic shock or jar to the crust of the carth, and whereins spread out in all directions, with velocities of several inities per second in all directions, with velocities of several inities per second production of the whole of the pround, may cause peneral destruction over a wide area. Alarming sounds issue from the bowels of the earth, and if the quales occurs near or undermenth the occua, it is followed by a series of great see warres (popularly missuander vified waves) called its seasons by the Japanese, which travel across the contraction of the property of the prop quake is invariably followed by a great numbe ally hundreds—of weaker shocks.

any nundrens—or wearer snocks.

Earthquakes are not always due to a single fracture
or close-set group of fractures, they sometimes have
very complex origins. Oldham has concluded that the
faulting to which the destructive shocks are due is the ranting to which the destructive shocks are due is the secondary result of an extensive readjustment of some kind 50 to 800 miles below the surface. It is possible that minor factors may contribute to the determination of the exact moment at which a stress near the breaking of the exact moment at which a stress near the pressing point will be relieved by fracture, these Omori has found an apparent connection between sainfail and earthquake frequency in northern Japant and several investigators have found similar connections between servicinates and barometric pressure a quality may be set off by an additional weight of air and water on the land

the land. The permanent changes of position of the ground in violent quakes take pincs simultaneously in opposite magnitude with increasing distance from the beak until they cause to be measurable at a distance of saveral miles. The dispensement, often amounting to 30 or 20 feet or more, may be horiental, vertical, or both This movement on goods of the of the fracture in opposite to movement on goods of the of the fracture in opposite directions is characteristic of the disruption of materials ess, and quite in accord with dynamical

an shocks are frequent and slight in a se region, the stress is constantly bring relieved, and there is less danger of a heavy quake, where quiet has reigned for some time, the shock which eventually es is likely to be severe, Earthquakes due to disturbances in connection with

on it distributes in connection with violunic operations also occur, but, while often severe locally, seldom are noticeable more than a few miles from their origina. Tremors occa-sioned by the collapse of underground caveras are likewise local and unin-portant. The storolic quises, bostonic is, those due to facilities of the rocks because a series of the control of the colla-tical control of the collapse of the collapse because already formed, may com-pletely devastate hundreds of square unlies of territory, and sand vibrations

breaks already formed, may completely derivate hundred or square
better derivate hundred or square
through the entire globe.

The vibrations or cleate warms
which spread out through the globe
from the fores, or east of hitsid
turknates, may be recorded by means
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Bird's-eye view of Japan, showing how the islands are formed by the teps of mountains which rise out of the sea

waters. But it is now generally believed that the steam is generated from water or other materials which have always been present in the depths of the earth

Rosthonakoa

The seismic regions of the earth are those in which extensive layers of rock of great thickness have been intensely folded, dislocated and elevated when the prin-

during an earthquaks. One set travels round the earth, in the errst, while the other goes through the inserior of the searth, the lister set, again, is compounded of two of the searth, the lister set, again, is compounded of two districts of the search o

graph record. A destructive quake is usua'ly registered by seisn graphs all over the world, at a distant point, the sels-mograph often continues to record small vibrations for two or three hours. The study of the records of numertwo or three nours. The study of the records of numer-ous quakes has made it possible, by noting the intervals between the arrival of the different types of waves, to draw curves showing the time taken by the various waves to travel given distances, and to construct tables waves to rawel given distances, and to construct tables from which the sistence of the reyline lying above the focus (the spécesser) can be determined for any point or which as seinmournam has been obtained. At most, and the special control of the spec

year Many tremors, occurring over small areas, are undoubtedly missed. small areas, are undoubtedly missed; and others, too faint to be sensible, are registered by the selsmographs. Our globe is trembling somewhere practically all the time. Milne estimates the total annual output from all sources to be 60,000 quakes. Forall sources to be to use quakes. For-tunately, the great majority of these are feeble and harmless, or else occur under the sea or in thinly populated districts. According to Milne, only 4151 destructive quakes tween 7 A. D and 1800

Japanese Earthquakes The most unstable region of the

The most unstable region of the exert at the present time is that allower active and a span, probably the most selsmic region of the globs, that seimed out as a science was born, about 40 of the British scientists J Miller, 7 J. Rwing and T Gray. The earthquakes of the Jupanese Empire have been studied more carefully than those of any other

The Japanese islands are arranged in the form of a festoon, with its convexity facing the Pacific Ocean, and, as in similar groups of Islands and in mountain-chains

of the same form, the con-vex side slopes more steeply than the other The Japan Sea to the west is shallow, but on the Pacific side, between the Japan coast and the Kurile Islands, the the Kurlie Islands, the ground plunges down into the great Tuscarora Deep to a depth of nearly 27,000 feet within 110 to 240 miles feet within 110 to 240 miles of the coast! The earth-quakes of Japan follow a law which is general in such cases: they are most numerous and violent on this steep slope. During the 21 years 1885-1905, for every strong quake origi-nating on the concave side of the islands, there were 16 on the Pacific side.

Earth tremors are a mat-ter of daily routine for the Japanese people, 12,700 hav-ing been recorded in the ten years 1865-1864, while from 1803 to 1807 the average

annual number was 1605. However, from 1601 to 1808, only 108 destructive a visited the country one on an average of every 2% years—and only a few of these rank as out-standing disasters. The quake of 1703 is reported to have cost 200,000 lives, In the Mino-Owari disaster

suffered from earthquakes and their effects in the past, the devastating shock f September 1 probably surpasses all previous disasters, although we have as yet only incompete reports and no scientific ob-servations. The Osaka ob-servatory places the epi-center in the Izu Peninsula The shock was violently destructive over an area extending 100 miles fo north to south and 130 miles from east to west, and having a population of about 7,000,000,

of 1891, 7000 perished. Grievously as Japan has Earthquake regions of the Western Hemisphere, shown in black

Other Great Earthquakes

Space will not permit of even an enumeration of all the great earthquakes of the past, but we may mention



Active and recently active volcanoes of the world. The active volcanoes are shown as dots, while the recently extinct volcanoes are shown as crosses

a few of the more notable. Tremendous losses of ble are reported in connection with some early quadrature. Thus, in India, 1747, 390,000 rar said to have perished, and again in 885 in India, 18000 The greatest disaster of modern times, next to the present one, was the Messfina-Reggio quake of 1908, with a loss of 100,000 lives. The most stependous shocks on record are the

Assum quake in India, 1897, destructive over 150,-000 square miles and dis-tinctly felt over one and three-quarter millions of square miles, and the Kan su quake in China, Decem-ber, 1920. The former was not notably destructive of life and property but in life and property, but in the latter the estimates of deaths run from 40,000 to 180,000, although as it oc curred in a remote region, from which news was weeks in emunating it at tracted little attention In the Sonora quake of 1887, felt over Mexico, Arizona, and New Mexico, an uplift of 20 feet occurred all along the base of a whole mountain range, but the regi-m disturised was only thinly inhabited The great Alaskan quake of 1899, in which vertical displace-ments of over 47 feet occurred, passed almost with-out notice for some time, More famous are the Neapoiltan quake of 1857, the extensive study of which by Robert Mallet was the first great scientific contribution to what is now the science of seis-mology, the Lisbon quake mology, the Lisbon quake and sea wave of 17%, in which 40 000 perished, and the Avessano shock of 1915, in Italy in which the ratio of deaths to population corded, 97 per cent of the people of Capelle having been killed (hile is also noted for some disestron quakes, the latest having been in November, 1922

A series of tremend shocks rocked nearly the whole of the then settled portion of the United States for many months in 1811 13 The topographic

effects of this New Madrid earthquake, as it has come to be called, are still plainly visible in the Mississippl valley, and aftershooks are still continuing. The Charleston S. C., quake of 1880 was relatively mild, but affected a were large area the San Francisco earthquake and fire of 1890 is neighbe for the great property damage, but the deaths were

few The entire Full Line of the Atlantic rd is a potential seat of earth

Prediction of Earthquakes

Possibly we shall some day be able to keep a record of the clastic vibrations of the earth's crust along danger lines, and thereby forecast a shock as we now do the coming storm But await patient investigations many years in the future

many years in the future

Geodetic surveys in Culifornia have
indicated an apparent creep of the
crust relative to the Sierra Nevadas, crust relative to the Sierra Nevadas, in certain regions of about three feet in ten years. Prof A. C. Lawson of the University of California, considers this slow displacement to be a strain creep which accumulates until relief is effected by a sudden slip or a rupture, and be believes that it may some day be possible to predict about

when the strains that are indicated by these movements will be released and cause a quake, Similar general indications may sometimes be obtained On the basis of the number of quakes in the years immediately preceding Omori in 1922 forecast the oc-currence of severe shocks in Japan within six years. Similar general indications may some times be obtained from a study of the migration of epicenters in successive rroin a study of the migration of operators in successive quakes along the seismic belts. A great quake relieves the stress in its neighborhood, and when next the stress finds relief it is likely to be at a more or less distant point along the belt. This is illustrated by the series point along the best This is illustrated by the series of shocks along the west coust of the American con-tinent from 1850 to 1912, as follows: Alaska, Sept 4 iment from 1880 to 1912, as follows Ambias, Sepf 4 and 13, 1809, and Oct 8, 1900 Mexico, Gusternaia, and other parts of Central America Jan 20, 1900 and April 19 and Sept 23, 1902, Panaran, Colombia, and Ecuador, Jan 31, 1906 California, April 18, 1908, Valparaiso Chile Aug 17, 1908, Mexico, April 15, 1907 and Nov 19 1912

The most effective means of minimizing the danger from earthquakes is through exhaustive investigation of the location and activity of faults, and the study of the effects of earth shocks on buildings and structures,

the effects of earth shocks on buildings and structures, together with the creation of an enlightened public opinion by the wide dissemination of selectific information by the wide dissemination of selectific information and negligance. Except where sea-aver and fire accompany the abooks, the loss of life is largely due to the shaking backs, the loss of life is largely due to the shaking vented by a knowledge of proper materials and suitable type of construction. Only in Japan, however, he has nich knowledge been extensively applied The native bound that the property of the property (Continued on page \$70)



Earthquake regions of the Easter

Our Abrams Investigation—II

A Test to Determine the Accuracy of the Electronic Reactions Diagnosis

As reported by Austin C. Lescarboura

Managing Editor, Scientific American, Secretary to the Scientific American Abrams Investigation Committee



IR FIRST test of the electronic reactions method of diagnosis took place on Saturday, September 15, in the in New York City At the invitation of this practitioner, whom we shall refer to as Dr A in the report which

reter to as or X in the report which follows, we brought to his labora tory a number of viats containing pure germ cultures for the purpose of determining the accuracy and dispatch with which he could identify the could id ir contents. This seemed a simple jet convincing

The laboratory, in this instance, is located on the ground floor of a typical high grade apartment house in one of New York's exclusive neighborhoods. It is here that Dr X carries on his diagnostic work, while in other rooms of the apariment he has a vast array of electrical and mechanical and luminous devices for the received not not remained in immunous vervees or treatment of patients. The laboratory proper is by no means bure of apparatus, indeed, it fairly bristless with various devices and tights. It might well be taken for an electrical or physical laboratory, rathor

than a doctor's consultation office First of all, there are large metal plates on the linok um floor, then there are numerous bare and insulated wires about the room, also, there are colored lights to one side, which, we are told, have to do with a chromatic method of diagnosis which does not concern us in our present inves-tigation, finally, there are several pieces of apparatus on the conventional white-topped table, which, at first glance resemble nothing so much as electrical measuring instruments or, better still,

radio equipment.

But in spite of all this equipment the main element in the electronic reactions method of diagnosis is the human reagent. Dr Albert Abrums of San Fre cisco, the founder of this new medical cult which has attracted nation-wide at tention, discovered a decade or so ago that the human body and blood had certain radio-active properties. Based on these early discoveries, Dr Abrams has worked out a method of diagnosis where by a healthy human being is connected in a so-tailed electronic circuit with a sample of blood to be tested, and the in-

dicative reactions are obtained from the human being, known as the 'reagent," at the hands of the skilled Abrams diagnostician. The reactions ar the skilled Abrains diagnosticing. The reactions are generally detected by percussing certain portions of the reagent's body—the abdomen is the area usually so-lected, although for specific diagnosis other areas are used. Percussing is accomplished by passing the extended and rigid palm of the left hand over the shdo-men of the reagent, and tapping the middle finger of the left hand with the middle finger of the right hand. The right hand finger is provided with an ordinary et lluloid thimble filled with beeswax and small shot, a as to obtain better thumping of the left hand Normally. the percussing of the abdomen produces a character-letic hollow sound over an area which persists unward to a line on a level with the lower ribs. When th to a une on a receiver unit ne lower risk. when he ex-tended hand passes above this line, there is a decided change in the sound produced by percussing. The hollow sound now becomes a dull that. The normal line of dullness having been determined, the reagent is marked with a black crayon to indicate the normal line

So much for the normal reactions, When, however, the reagent is connected with the electronic circuit and a sample of blood or other representative matter from a patient and when the electronic circuit is adjusted for various 'rates' of vibration by means of a bank of switches the area of duliness either remains at the normal line or drops down some two inches.

Let us so through a typical diagnosis, so as to make the workings of this nethod sufficiently clear to go the workings of this nothed sufferently case we ashead with the business of our first test. To begin with, the sample of blood or other matter is wiped, so to speak, with an ordinary horseshee magnet, so as to sluminate extraneous electronic injuressions. It is logical to assume that any sample, in the course of ordinary

handling, must pick up its due share of thes nananing, must pick up its due snare of these electronic impressions which we are given to understand permeate everything and everywhere But why the electronic values of the patient, with all their delicate shadings and varying degrees of strength which go to make the diagnosis so critical as compared with orthodox medical practice, are not also wiped out or at least seriously impaired as the result of the magnetic wiping, we do not profess to know We are still woefully isnorant on

At any rate, the extraneous electronic impressions are At any rate, the extraneous electronic impressions are wiped out and the sample is placed in the so-called dynamizer, which has also been wiped with the hard-working horseshoe magnet in order to wipe out elec-tronic impressions that may have stayed behind from previous samples. The dynamizer appears to be little more than a nest, round container, at the bottom of which are two electrodes whose ends are separated by a small air gap. These two electrodes are generally con nected together and the single lead then goes to an amplifying device and to the array of other instrume The dynamizer is provided with a close-fitting cap the or side of which has a metal plate connected with

ice array of other things with terrifying names and liberal changes—about for a long while back, without even suspecting the fact, until he was confronted with

even suspecting the fact, mill be was confracted with his electrical received diagnosticals good to "rate 50," for only From "rate 50," the diagnosticals good to "rate 50," is react to that rate, then the second bank of written reacts to that rate, then the second bank of written is manipulated to restore the normal line of dulines, and a reading in clams is taken for congenital sprintle. And so the diagnostician goes down through a long list of "rates" which stand for as many almosts and the of "rates" which stand for as many alliments and dis-sease and afficients. There is a set routina, of course, such as acquired applilia, congenital applilia, tober-such as acquired applilia, congenital applilia, tober-phole, maintris, influenza, and no co. Ineddentally, we might need to include the constraints of the person who escapes without a trace or more of congenital applilia in an electracia reaction diagnosis. Hence there need be no hard colorings we're all pretty much allia, elec-traciants and the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the contract of the con-tract of the contract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the con-tract of the contract of the contract of the contract of the con-tract of the contract of the contract of the contract of the con-tract of the contract o

The result of an electronic reactions diagnosis is a list of "rates," their corresponding medical terms, and their extent in ohms. Following such a diagnosis; the patient may be treated, if he so desires, and "cleared" of his various troubles.

and "ceared" of an various troutees.
Some "rates" clear rapidly, while others require some length of time. When all the "rates" of a patient full to give a reaction through the reagent, then that patient is considered cleared, or cured.

This method has to do with a diagno-

sis by proxy, so to say, in that the pa-tient need not be present. There is no other feature of the Abrams teachings that is more spectacular—or more unbe-lievable. Here we have a means of diagnowing a given case at a distance without the presence of the patient, indeed, some one has promised to diagnose Egyp-tian nummies in order to determine the diseases which prevailed in the distant past! Skilled Abrams practitioners will assure you that they can take a specim assure you that they can take a specimen of your handwriting and not only tell you all about your medical history—part, present and future—but also your racial strains, religion and other choice bits of ivate information

If the patient pro

is the patient prefers, he can be examined directly, in which case he takes the place of the reagest and no sample of blood need be placed in the dynamiser. In the examination of the writer, he served as his own reagent and had his abdomen and other parts of the body percussed to determine the various "rates". and ohnages. Aside from percussing, there are other methods of detecting the reactions, such as the attrac-tion and repulsion and sticking of electrified glass rods tion and reputation and success or essectrized glass rods passed over the reagent's body, as well as the deflection of pith bells such as are used in the physics classroom in an early issue we shall have more to say about the apparatus or the mechanical side of this interesting

Coming back to Dr. X and his laboratory, we start in with the reagent, whom we shall call "George" for short. George is a handsome lad of about 16 years of age. He has a receasible physique, which was all receasible physique, which was all receasing the start of the start of age. He has a receasible physique which we have breed entirely to earn as the reagent in a previous informal past. On the day of our present test George appeared to be in the plant of cendition Dr. X asked George if he had taken his mean! quota of he water, and the start of the start of the start of the water of the had taken his mean! quota of he water of the had taken his mean! quota of he water of the had taken his mean! quota of he water of the his mean. The start of the his mean to be considered with the start of the start of the his mean. The start of the start

connected at this ginace, and the arround our assignment.

closs. One of the grounding wires was traced to a water-pips, which happened to be coated with paint.

Here, we thought, was a weak point; but further examination disclosed additional grounding wires running to steam pipes and making good "grounds." At any rate, we were entirely disarroued in this direction when George

RESULTS OF THE ELECTRONIC REACTIONS

The pure germ cultures used in this diagnostic test were as follows: Tube No. 1—Typhoid. No. 2—Prasumococcus No. 3—Colem Septensemia. No. 4—Colem Septensemia. No. 4—Tetanus. No. 5—Tuberculosis. No. 6—Diphtheria. The tubes were handed to the electronic reactions disponsitions with labels carrying the corresponding numbers, and the findings in ohms are given below.

		No 1	No 3	No 3	No 4	No 5	No 8	
Acquired Syphilis		26		66	••			
Congenital Syphilis		146	49	27		+	148	
Tuberculosis		7	6	7	+	÷	8	
Gonorrheal Infection		88	89	16		÷	200+	
Streptococcus (Pneumoco	ccus) .	153		49	••	÷	87	
Malaria		59	17	17	89	+	28	
Typhoid						••		
Influenza		210+	- 36	46	22	+	••	
Colon Septecaemia .			58	9	22	÷	68	
Diphtheria		Not	tested.		8	Not te	sted.	
Tetanus		Not	tested.			Not te	sted	

the other apparatus, consisting of multi-contact switch So far, so good The reagent, stripped from just be-low the waist, up, takes his place in front of the diarlow the waist, up, takes his place in front of the diag-nostician, singling on a pair of grounded sinc plates. The diagnostician is ready to begin work. He deter-nines the normal line of dulines, puts a mark on the reagent's abdomen, and adjusts the little switches of the diagnostic maschine for the first "rate" of vibraties, which is 55, designed to permit only acquired apphilis electrons, or whatever they may be, to filter through

to the reagent
The diagnostician now percusses, and notes if the
area of duliness has dropped down below normal. If it
has not, the patient is "clear" on that score. If it has,
then he manipulates a second bank of switches in order to obtain a quantitative reading. The second bank, like to obtain a quantitative reading. The second bank, like the first, is arranged with switch points in suitable multiples representing ohms or resistance introduced into the electronic circuit. The diagnostician adjusts the switches of the second bank until the area of deli-nose in the reagent has receded back to normal, indi-cating that sufficient resistance has been introduced to choke off the flow of the electrons of that given "rate."

Thus the diagnostician obtains not only a "rate," which in this case is 55, which according to the Abrams which in this case is 00, which, according to the Abrains chart of "rates," represents acquired sphills, but also a quantitative reading in ohms, such as 8 ohms, 6 ohms, 15 ohms, and so on. The "ohms," of course, represent the degree of the silment or affection. We are told that the charge on the sufficient or anaction. We are food that the charge does not run uniform for different rates. Thus in tubecculosis 3 chms is sufficiently serious to require treatment, while in mainta one can live quite combrably with 17 chams—the writer of these lines has been carrying 17 chars of mainta—not to mention a proceeded to heat the plates by means of a standard electric light consented to one side of the curves under selectric light consented to the side of the curves under plates and producing sparts as the lamp blased up. This satisfied us that the plates were restly grounded, atthough semingry Goorge went booth his work quite universe of our suspicions and purely as a matter of souther. As a bit of stage officer, however, it was excellent, to say the least. Even our technical mind, weil southern the second of the se

cenent, to say the least. Even our technical mind, well versed in electrical practice, was monestarly impressed with the logic of the thing By now our committee was mobilised. For this test there were present an engineer, a bacteriologist of the Bureau of Laboratories, Department of Health, City of New York, and two members of the editorial staff of the ECREPTION ADDRESS.

the Schierty A Alestocks. The X and his assistant, a profit for the weak of the In X, senged with an profit for the West and and In Y, senged with an in a screptionally interesting conversation. The idea of the Interesting work as well as some of his extraordinary cases, the most starting of which was his recent treatment of a notorious character in This poor creature is a carrier of typhoid and his given New York no end of trouble Dr X told us not health substitute that the Interest of the New York no end of trouble Dr X told us how the basis has his character in the Interest of the New York no end of trouble Dr X told us how the basis has his character in the Interest of the New York no end of trouble Dr X told us how the basis has his character.

cold as how the heath route ortics, as the wind as how the heath route of the his written, had sent the said "Ty photol Mary" to him for a test travel or "Typhotol Mary" materly, not to for "Typhotol Mary" materly, not to for "Typhotol Mary" materly, not to for which the electronic reactions diagnosis disclosed, said "Typhotol Mary" was turned out in Bg itine, "closed of her sliments. This, obviously, was turned out in Bg itine, "closed of her sliments, the control of heat of heath of

During the discussion between Dr X and our bacteriologist, the latter brought out the point that a typhold case runs in cycles, with a return to negative every so often Could Dr X have turned out "Typhold Mary" at the low point in the typhold cycle? We do not know

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But to go on with our main business after the preliminaries which
resulted us in to rittle degree of a

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done requisity as contrasted with the
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bared his business proper garments and
who stood on two ground plates.
George put on the bandgare and arm electrode. We
were saked to ground oursives, by taking hold of elepare germ culture in its little will carrying only

George put on the headgear and arm electrode. We were asked to ground ourselves, by taking hold of electrodes connected to ground wires. And then the first trodes connected to ground wires. And then the first more than a red-bordered label with a plain, hand-more than a red-bordered label with a red-bordered label with a red-bordered label. The red-bordered label with a red-bordered label label label label.

tance from the reagent. At this point we present in a slight At this point warmen, as were told, must be related to a slight face away from the respect in order not at least eight face away from the respect in order not be thated, Dr. X pointed out to us the latest discovery of Dr. Abrams, which takes the form of a horsesion mener maganifed a few incluse over the head of the re-close of the respective of

You have already learned from what has gase before that the electronic rections practitioner goes from one "rate" to another "rate" in making his disposes. And in the event that the dissess to be discovered is not all the second of the second of the second of the his hunt after the manner of a search for the provential models in the haystack. So, in order to save time and effort, Dr. X suggested that we give hit is a general idea of the second of the second of the second of the second of the discovery of the second of the second of the well of the second of the second of the second of the well of the second of

The lights were dimined—electronic rescitions must be carried out in a dimined attemptive, so as to have a minimum of light users, interfering with the delicest processes involved. Dr X beam his search, percussing as he went from one rate' to another. He amounted its various findings from time to tim. The first test turned out to be goour-het, according to the electronic rescitions, but not according to our records. That was rescitions, but not according to our records. That was not according to the contraction of the contraction of the accepted procedure.

Then followed tube No 2, for which the reactions disclosed congenital syphilis—true to Abrams form, tuber calosis, colon septeneous, sireptococcus, malaria, ituwell, that is as far as we went with that tube. Other "rates" would perhaps have given additional reactions.

The Electronic Reactions Diagnoss
The dissenting of the human
of the human reagent by means of his matends left hand, which is thumped with the
hand flager were a weighted thinking. The
compass mark on the reagents alike The dynaminer and the weighten appear on the table at
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but we had ample Needless to any we were keenly disappointed with such indings. One specific answer should be sufficient. Here was a vertiable broadside, not necessarily aimed to bit something through mere chance, but certainly open to such suspicion.

At this point Ir X logan to display some converment of the point Ir X logan to display some converove the results of our test Frankly, he agreed with its that pure germ cultures should be resulty differentiated one answer for each tube. The purity of the germ cultures was questioned, and their origin was clearly stated in syntaction beam of the tube contained 24 the pure stock of the Research Laboratories of the Department of Health, while others had been prepared by scraping the growth off states of saidline cultum in the state of the states of said in cultum and which was then stoppered with a rubber stopper and which was then stoppered with a rubber stopper and which was then stoppered with on the preparation which was then stoppered with on the pure possible of the distribution of the control of the control of the by hand in blue fait, were pasted on the appropriate tube for identification purposes. Dr. X signified maxiety over the recognit II appears that Gerory, robust as he is, Georges was asked to "short" himself, which he did by potating his hands toward his side Normally, his hands are held down at his side, with palms facing forward and cutward. George proved to be in the plats of eletropic condition, for he brought his area of deliness right back to normal, even with conditions set for a strong resulting.

Then followed a talk about the super-sensitivity of the electronic reactions, in Y. Xuought out the point that the electronic reactions are far more delicate than any thing now in the hands of the bacteriologist, including the ultra ultra-olderoscope. Fore germ culturers may mean the property of the p

A third tube was tested Acquired apphilis, congenitate spidlis, tubercu losis (slightest trace), genorrhea, colon septea unin malaria and flu, but no streptococcus, was the verdict. Another broudside! Well, it was evident by now that

Well, It was estiont by now that the electronic resultions were not proving their case. So the writer suggested that, inassuch as we were dealing with pure gorm cultures, small before the many their one "rate" as compared with the other "rates" which were due to traces of by-some associations. Dr. X thought this lote cupini and

Dr. X thought this life cupital and we began to test the pure germ cultures on the basis of ohms instead of the cupital and the cupital season of the cupi

It nos, things were not happy with the dector of trails realised that the dector of trails realised that accessfully not 80 be sought some reason for his flat fullure. It asked to look at one of the pure germ culture value. Looking at 11 in full light, presumably for the first time he discovered the red edge on the label as well as the blue handwritten.

But then making in a the fibre handwriting for the manifest party of the fibre in the successful district the manifest party of the destroit related failul to the accuracy of the electronic recardings the failul to the accuracy of the electronic recardings. The presence of that bild of red on such label was sufficient to upset the rancions completely. And by was of thring from the fibre of the support of the support of the fibre o

Burthermoor there was handstriting on our labels. An official to the description of the labels were being carried along in the diagnosts. It so, the writer of those labels were being carried along in the diagnosts. It so, the writer of those labels must have been in a terrible state of besulth—and mind, so we reflected at the time Anglin, the labels were of the guinned variety, and might have been liked, continued by Y. Here our one of the first things a haterichologist is mind, it is not to like labels. A rather unbealthy practice, it would be, with so many touches hat terral battle of the production of the first three unbealthy practice, it would be, with so many touches hat terral battle.

Well, this matter of labels had to be taken care of if our test was to proceed. So a member of our committee went into the doctor's office and wrote a set of plain (Continued on page 370)

Within the Atom

At the Very Foundation of Matter with the Electrons and Protons

By Sir Oliver Lodge



h HAVE gradually learnt that electricity exists in two forms, the nega tive form, which is called an electron and the positive form, which is now leginning to be called a proton There is no other kind of electricity so far as we know. The material universe seems to be built of these two elements. Both the electron and

PORTUNATE indeed is the SCIENTIFIC AMERICAN in being able to present to its readers on interesting, popular article on the structure of the oton, written by the comment Brish ascential. Six Oliver Leader By common consent the assemble of the oton, and the present the control of the oton and through places the little day and litting places that little and litting the other commonly believed to make up our Universe, have been commed, mustly, such success. We commonly believed to the been able to desue unitruments that in present the comment of the latent of the others interested the other structure.

has been able to devue instruments that never-

theless enable us to appreciate them with our weak senses, of which these instruments be-

come, as it were, powerful extensions,

the proton are exceedingly small very much smaller than an atom of matter Both probably have weight, though one is much heavier

than the other The proton weighs as much as 1830 elecweigns as much as 1850 efec-trons. But it is not appre-ciably bigger, and some even think that it may be smaller than an electron. The fact is, we do not know very much about it, except that it is the unit of positive electricity, just as an electron is the unit of negative electricity Whether the proton is an ultimate unit or whether it can be resolved into a close-packed assemblage of sin-pler ingredients, which would account for its remarkable weight or massiveness, remains for future discovery It may have a complicated re for all we know but at present it seems to us one and indivisible. No does the electron

arenthetically, we may say that both are hypotheti cally supposed to be probably built up in an unknown way out of the other of space, so that they need not be foreign bodies in the other, but a specifically organor moving notices in the other, but a specifically organ-leed portion of it. But all this is at present hypothet-cal and need not be emphasized. Suffice it for present purposes to say that both electron and proton certainly tist and almost as critainly that they constitute the apparently individual colorants of which all matter is

They are, however, both closely related to the other somehow, for they attract and repel each other That is to say, there is a strong mutual force urging electrons and protons together, and at the same time keeping apart the units of the same kind, and this force, whether of attraction or resultion must necessarily be exerted through and by means of the intervening ether Furthermore, we know that when either is in motion is surrounded by a magnetic field, which magnetic field consists of some modification in the other, and extends rable distance round the moving nucleus or kernel. These facts are commonly expressed by saying that a moving charge has two fields of force, one, radi ating from it in all directions, is called its electric field while the other, which surrounds its line of motion in rings -covening out more and more of them and crowding them closer together as the motion in-creases in speed—is called its magnetic field. It is this last which confers upon each unit its fundamental property of inertia, that is, its power of persisting in motion until it is disturbed—thecked, hastened or deflected—by some external force
The size of these electric units is now known

fair accuracy. But about their shape nothing is known It is natural to think of them as spheres, but there is no evidence for that shape and no reason can be given why they should have that shape. The spherical shape is characteristic of large masses of matter, such as suns and planets, and for good reason. A large enough body must be spherical otherwise it is unstable. A great mass of matter of tregular shape or even of regular shape, like a cube or a cylinder or an clongated oval, could not remain in that condition. Its protruding portions would be pulled down and merged in the rest by gravitative attraction. But no such force acts effectively on a small body It is too insignificant in amount to be effective. Accordingly, the shape of a small body has to ervation It may be like a mart but it might equally well be like a ring, or a styponce, or a corkscrew. Or again it might be shaped like a feather, a seed, or a tadpole. We assume that every proton is like every other, and that all electrons are proton is like every other, and that all electrons are ulike, too. But we do not know even that for certain. Meanwhite, it is natural and simple to think of them as little spheres, always bearing in mind that there is no evidence for that assumption, and no evidence

We know so much about these units now that it is well to remember from time to time the points about which we are still ignorant. We know approximately their bulk and their mass, or what is commonly called weight But of their shape, structure and constitution
we are ignorant We know

that a proton weighs just about the same as one atom about the same as one atom of hydrogen, but that it is in bulk a million million times smaller We know that an electron is comparable in size to a proton, but is 1830 times lighter or less massive This 1830 is an experimental lighter or less massive inis 1830 is an experimental number and does not pretend to be quite accurate It may turn out to be as small as 1820, or as large as 1860. But the best measurements lie between these two ex-tremes, and 1835 is a very tremes, and 1835 is a very reasonable value, according to our present information This may seem unimportant, but I mention it as showing how precise our knowledge out these things is gradu

some difficulty in getting an unconfused, clean-cut conception of the beliefs at present

held by the majority of scientuts concerning

the various inter-relations of these components

the various inter-telations of these components of the atom. In the accompaning article the datinguished outbor demonstrates a facility much, on the part of the higher scientist, is rare—that of pating himself in the place of the more of less popular reader of science and making this phraeology and style plain, simple and free from the parting isolonicalities that, while A-B-C to himself, carnet with competitive of the followed by the average reader.

ally becoming
In the same spirit I can say that the diameter of an electron has been measured as 37% times the hundred-million millionth of a centimeter. And that the weight of an atom of hydrogen, meter And that the weight of an atom of hydrogen, with which we have above compared it, is 108 times the weight of a milligram divided by one followed by twenty-one 0's, That is to say, that an atom of hydrogen weight a million million timilion times less than a minute visible speck, such as a granule of lycopodium, which is about as small as can be weighed on a very delicate chemical balance.

A special fact may here be mentioned, as tentifying to the correctness of our knowledge as far as it goes. An electron has a certain exceedingly small mass or weight, but when it is moving very fast-much faster than any-

thing we ordinarily know of —this mass or weight ought. crease, by an amount which can be predicted. Such an in crease was, in fact, pre-dicted, and its amount calculated at various high speeds short of the speed of light Experiment subsequently became possible, quently became possible, with the particles shot off by radioactive substances, and when the mass or weight of these violently fly ing particles was measured, and compared with the the-ory relating to the increase expected, the calculated and observed values were found to agree exactly These-scien

confirmations, ought to be better known and understood by the world at large. The increase of mass with speed is consistent t Relativity doctrines, but it was fully known before that. Only, now we feel pretty confident that the same thing applies to all matter, and that matter is there-fore electrically constituted

fore electrically constituted
That these minute corpuscies can build up giganic
bodies such as the earth, the planets, the sun and the
stars in astonishing—like most other things in the
universe when we dive down into them But yet it
seems an undoubted face for which the evidence is exceedingly strong, so strong as to be practically con-clusive It has long been known and admitted that these great bodies are built up of atoms, and now we have learnt that the atoms are themselves built up of executions and purious. And we have begun to learn what is the structure of an atom, that is to say, how it is built up out of its constituent elements—the opposite units of electric charge. We are now, however, entering on a region where some debute is permissible and some differences of enlightened opinion may exist. But the proteines which holds the field, and the one on which Rutherford and Bohr and others are worked to be a supersystem. That it so have that to consist not become arranged like the sun and planes, on a very minute scale First of all we find a group of protoss in the have learnt that the atoms are themselves built up of scale First of all we find a group of protons in the center, half of them presumably welded together by a compact and interleaved assemblage of electrons, which are also able to hold on the other half of the protons as are also use to note on the other half of the protons as part of the compact group. This central group repre-sents the sun, and outside it, and at some distance from it, we find a regular series of electrons revolving round it, either singly or in rings, like the planets, or possibly in some cases, though less likely, like the Ring of factors.

Furthermore, it has been found possible to count the outstanding or unneutralized protons and electrons in atoms of different kinds.

By "atoms of different kinds" I mean the chemica By "atoms of different kinds" I mean the chemical elements, Irica, join, sinc, carton, corgen, hydrogen, sulfur, gold and radium and all the eighty-three other elements or which the world is roomood. There seems no doubt about this counting, though it is a remarkable solleviencent. It is the result to work done by several living mean, such as I tutherfurd and Furchia, and espacially by young Mowley, who was tilled by a Turkish bullet shot through his brain at Galliput—semarkable sections to the effects of war in setting human

The number of unneutralized protons at the center and the number of unneutraneau protons at the center, and the number of planetary or revolving electrons in any given atom in its normal state, must be the same. Many or few, there must be the same number of each, wise the atom would be electrically charged, and would not be in its norms condition. One electron too many would yield a negatively charged atom, two elec-trons too many would be doubly charged, and a few trons too muny would be doubly charged, and a rew atoms might be even triply or quadruply charged. But such charging must be considered exceptional and not likely to be permanent, for these additional electrons would be hanging on in the tech of some repulsion and would soon be likely to escape

On the other hand a deficiency of one or two electrons in an atom would mean that it was positively mean that it was positively charged, and that, too, would be an unstable and excep-tional condition. For the electrical force exerted by EVERYONE is familiar, at least with the words "electron", "proton" and "nucleus", but many have experienced

such an atom would be very great and would soon be able to collect stray electrons and thereby restore the balance to equilibrium. When the to equilibrium. When me charge of an atom is unbal-anced or not neutralised the atom is readily guided and propelled and, as an easy traveler, is called an "lon." It is not to be supposed

that the protons and elec-trons here spoken of as contributing to the central posi-

tree charge and the equal periphyeni negative charges are all the protons and electrons that seids in the ston hencies may contain many more, and in from hencies may contain many more, and in from the contained of the contained tribute to its chemical for to its radiative properties. They are more like an inert mass of satisfied material upon which the other more active and demonstrative units are grafted. The compact central mass does not contribute to fits electrical behavior, which is the most conspicuous phenomenon in an atom, whether it be re-garded from the physical or chemical side; they contribute only to its weight and mertia and mechanical

properties generally.

Onsequently, the inert part of the central mass is often ignored, and seemed to be of minor importance until some means was found for breaking it up. Attention was and is concentrated chiefly upon the outlying tion was and is concentrated chiefy upon the outlying, negative electrons and upon the corresponding number of protons which by their electrical attraction hold them have been common, and there are what are chiefly important to our present knowledge. But the others do not escenge detection, and it is easy to count them, too—in fact, quite easy, for they are responsible for the another weight and new at once determined by the weight atomic weight and are at once determined by the weight of the atom Given that an atom of hydrogen contains one proton, and weights one, then an atom with atomic weight 16 must contain 18 protons. But hot all these are active, only 8 of them exhibit electrical forces and hold 8 electrons in orbital movement. The other 8 constitute the rest of the nucleus and represent its electrical forces. cally neutral nortion.

with an element of atomic weight my 31 Sixteen of them are inert and 15 of them are electrically active. The active number are what determine its chemical and spectral behavior, and it is became at he are selected and spectral behavior. So also with an element of atomic weigh are what determine its common and spectral behavior, and it is known as the atomic num-ber of the element Roughly, it is usually about half the total number, sometimes exactly half, though in all cases rather smaller than

half, though in all cases rather smaller than half when not exact.

An one can tell how many protons altogether there are in an atom. Shuply the number ex-pressing its atomic weight on the scale in which oxygen = 10. The interesting thing is how many of these are chemically or electrically active, and this is given by what is called the atomic number Of this number there can be no fraction, and it proceeds regularly through the different elements from 1 to 82. Nearly all these 92 elements are known—there are only three or four gaps—and any day the few outstanding gaps may be filled by the active and enlightened investigators of the

present day.

If we now ask how many electrically active protons, and how many electrically active electrons, go to make an atom of sadium, the an swer is forthcoming. The number is 11 of each If we sak the same question about chlorine, the number is 17 of each. If we ask it about carnumber is 17 of each if we mak it shout car-bon, the answer is that six of each kind of electric charge constitute the affective part of the atom of carbon constitute the affective part of the atom of carbon elements and the cus-tion about lead, the answer is the superstag number of 82 of each kind. If we inquire into the constitution of radium we find 89 of each kind, 88 active protons along with 87 of the insert or satisfied variety exist at the center, even and the contract of the con else grouped in some pattern, are attendant round the central nucleus or sun The heaviest known element is uranium, and for that the known element is uranium, and nor that the number is 82. No element with a greater num-ber than that is at present known Possibly any greater number would be too unstable to exist for any length of time, so that it would exist for any length of time, so that it would be extremely rare. Even translum is not quite stable and if we were to watch an atom of uranium for a sufficient length of time—which would be a very tedious business, for we might

would be a very fedious business, for we hight
have to wait a thousand year—we should see (that is,
mentally "see," for, of oourse, an atom is hopelessly
highting have been considered to the property of
and we should see electrons seezing too, two packed
up with the protes group and two thrown off separately, showing that of the four protess two the see.

The limit protest of the protest see of the four
highest seed to the four protess two the seed to
the limit protest of the niceless and to together washing. the inert portion of the nucleus and two from the elec-trically active portion, so that the projectic retains a double, not a quadrusile, electric charge. The number consisting of a quadrusile, electric charge. The number consisting of the consistency of the consistency of the same recently, but another elevent called uranium X, and this also would explode or fee off a particle in time, so that the number would then be reduced to 88, whee the main or reductal substance would be radium. when the main or paidoal substance would be radium. Then it might go on with rather increased entirely, though still only very occasionally as for a seek attent to well nated in the median time of the main of the contract of the model of the contract of that is not in the true line of descent) it would be gold. So much for the heavier, unstable end. But what

about the lighter elements? Carbon, for instance, has only six pairs, oxy gen has eight, nitrogen seven, lithium has only three. Hellun, that comparatively rare, there gas, found by Sir William Ramsey to be given off by cer-tain unnersia and by the hot springs at Hath and other places (given off also during the disintegration of places (given off also during the disintegration or radium), an elsement first discovered spectroscopically or "bullon," as we now see that it ought to be called, has only two Butth the first known of the intergrasse, the one discovered by Lord Barbidh, vis. arosa, has the one discovered by Lord Barbidh, vis. arosa, has be fit must contain four proteas in all aid not occurse, also four eise treas. Two of these seems more chosely also four eise treas. Two of these seems more chosely labelded in the structure than the other two, but all extremal field and accordingly is chemically incre-nent that the atoms are unable by sixtenity to hold to-gother by cohedion. Therefore it evides as a gas con-desting of instanced atoms. The anablest justice or permi-cialized of instanced atoms. The anablest justice or permi-



Sir Oliver Lodge, Principal of the University of Birmingham and leader remearch on the nature of the a

cation will separate such atoms from each other and, accordingly, it can be liquefied only at an exceedingly low temperature, very close to absolute zero. For at that low temperature the footling practically ceases and

that low fessionerature the joiding practically ecases and the atoms are on narty quiescent that the bonds of their devide residual affinity are not broken. The properties of the properties of the properties of the thought of the properties of the properties of the properties, but whereas an atom of helium is ele-trically neutral an athian particle is by no means neu-tral it has a double positive charge and it needs two ele-trons to satisfy it. But these it soon picks up, and then it becomes the completely assisted and inert atom of helion. This 4-4 have become 4-4

Is there any element that has only one constituent pair, one proton as the central nucleus and one revolving satellite, like an earth moon system? Yes, the answer is definite and carrian. The lightest known element is hydrogen and hydrogen has only one of each. The hydrogen at an is constructed on the pattern of the auth and not. of the earth and moon

Thus there are exactly ninety two elements and no more One cannot imagine an element lighter than hydrogen, unless it is possible to split a proton and an

electron into fractions. It is easy to imagine an ele-ment heavier than uranium, or any number of them. Hence, in that sense, there may be more than ninetytwo, but not by interpolation, only by extension of the two, but not by interpolation, only by extension of the heavy end. And silhouth, such elements have been looked for—notably an inert gas with the atomic num-ber 118, which might possible, have been expected— none of them has an yet been discovered. The evidence on the whole is against their probable or foregoing to the whole is against their probable or required in complex and probably still more unstable elements, under swell of confillment of temporature and incomment. under special conditions of temperature and pre remains a subject for future discovery

remains a subject for future discovery.

The building up process we have not learnt how to mecompilate, nor have we ear observed it going on. The tumbling down or binitegration process we have observed it consultates the phenomenon called radioactivity. But even that we are unable to control. It goes on the control of t ity But even that we are unable to control it goes on spontaneously or not at all Nevertheless, it goes on with great violence. The atoms really do explode, as a cannon explodes, firing off a shot with great when more at a speed of several thousand miles

with medic he a spect of section indicates a second.

And the nature of this shot has been ansatzed we might have expected it to be a proton. But, strangely enough, it is not Assisted above, it is a group of four protons, whiled together by two electrons, all apparatures the strangely enough its protons of the protons o ently jammed together into a compact mass, without any satellites or revolving charges. The projectile really is a projectile The projective result is a projective weigning four times us much as an atom of hydrogen. And, moreover, it is not in a permanently stable could from its seems stable enough mechanically but not electrically. It has four positive charges and only two negatives. Con-sequently it is electrically unbulanced. It has a double positive charge.

A projectile of that kind, moving at that tremendous speed, is quite a serious thing and can do a lot of work before it is stopped. If it hits a phosphorescent substance it emits a flash at If it strikes another atom it might do some damage.

But if an atom is like a solar system But if an atom is like a solar system, we might will now, what is there to rivine? Will it not rather go through an atom? Certainly, that is what is to be expected, and that is what is to be expected, and that is what ingrees. Atoms are exceedingly promatively to his many through them is quite unlikely to his many thing. But every now and then it may thing But every now and then it may not through ten thousand atoms without hitting must, on the decirin of chusew It may go through ten thousand atoms without hitting anything, but if sand atoms without nitring anything. But it ten thousand projectiles were loosed through the solar system at such speed that gravitation had no appreciable effect, one of them at least might hit the sun, and then something would

happen Sir Frnest Rutherford has tried the expe ment with nitrogen. He has got one of the radioactive materials, offsprings of radium, to tire its projectiles through nitrogen gas. Thou ands of them hit nothing or encounter only one of the electrons, which they may be able to sweep up and carry away without much disturbance, for an electron is such a light thing itut occasionally they may hit the nucleus. And the nucleus of nitrogen is fourteen times as heavy as hydrogen, while the projectile is four times as heavy lience the encounter is no triffe

four thies as heavy. Hence the encounter is no trace. The experience is like fring a crowd of name, each a quarter the weight of our sun through the solar system. Many so through free and so on, some night sweep up and curry away one or other of the seven planets. But one by chunce encounters the sun likelf. There is a small and the sun breaks up. The atom of Artrogen is disintegrated, not be spontaneous radioactivity and by its own energy, but us by the explosion of a shell or the impact of a violent projectile

And what happens to it? Is it dispersed into its con And what nappens to 117 is a dispersed into its con-stituent protons, or do some of them hang together still? The answer can only be given by experiment. The an-over found by Rutherford is something like this that most of them hang together in groups, constituting three atoms of helion, while two odd ones are flung out with great speed-even greater than that of the projectile which drove them—so that we get violently ejected atoms of hydrogen.

atoms or no dregard. It is no if the atom of nitrogen were really composed of three helton and two hydrogen atoms—as if it were a compound of those primary elements and that it was distincerated or broken up into its constituents by the impact of an alpha particle
(Continued on page 372)

Our Point of View

Navy Day

ECAUSE of the inevitable decline of interest in the Army and Navy which manifests itself at the close of a great war, the setting apart of one day of the year as Navy Day, on which the country is asked to give thoughtful attention to naval affairs, is altogether commendable

Speaking in favor of the institution of Navy Day, and having in mind no doubt the pernicious propagands which sims at the immediate abolition of all armsments, President Coolidge recently said "Our country has undertaken as its proper contribution to amelior ating the burdens of armument in the world, to pla certain strict limits on our naval establishment. In view of these, it becomes desirable that the highest efficiency in men and nuterial be maintained." the same purpose, Acting Secretary Theodore Roosevelt reminds us that "behind the protection of the Navy our people are able to carry on their lives, develop their ideals and live in the righteous peace we so earnestly desire. It is the right arm of our State Department !

Of the misleading statements made by those who would emasculate, if not altogether destroy, our Navy none is more false and unjust than that which describ the Navy as a symbol of war and its officers and men us the advocator of war. As a matter of fact from admiral down to enlisted man, there are no citizens who are more united in the carnest desire for peace They know what war means. President Kelly of the Navy League is well within the truth when he states that no men are more truly pacific than our Army and Navy men-"our own brothers and sons, who reulize e keenly than others the horrors of war, and seek only the strength that will maintain peace-the peace of honor and justice which is the only peace America should ever tolerate

When the history of the stupendous events of the war and the post war period comes to be written and they can be judged in their true proportion, we believe that the gathering around the table of the five leading naval powers at Washington to frame the Treaty of Limitstion, will be recognized as perhaps the greatest single contribution of the United States to the permane peace of mankind. That treaty has now been ratified by all the powers concerned, and they, with us, are at present engaged in breaking up the superflows material of over-developed navies.

Let no one regret this destruction, for this superflu ous armament was the child of suspicion, fear and international hatred. The fleets as reduced by the treaty are no more nor less than the international police of the high seas. It is the duty of the American p to maintain its present Navy, which is preeminently a preserver of the peace, at its highest possible level of efficiency, and give to it at all times loval and patriotic

"ZR-1" Sails Over New York

UR FIRST sight of "ZR-1" was from the servation platform of the Woolworth Tower, as she reached New York City exactly at the hour predicted. It was in midmber, and a faint hase, suggestive of Indian Sum days to come later, softened the outlines of the city below. Precisely at 11.30, out of the air came the distant drone of the airships motors, and lot above the Statue of Liberty there became visible through the hame what looked for all the world like a gigantic silver bubble, which grew in size until the great ship swung to port and revealed the whole 690 feet of h truly beautiful form to view With her six motors throttled down to half spred and the national flag snapping at her stern, she swept majestically by as she laid her course up the Hudson River

Apart from the beauty of the spectacle (and a silvertinted dirigible, when seen under such conditions, is an undeniable object of beauty) the most striking impression was that of the stability and perfect control of the

vast ship, which, be it remember red, in spite of the light and fragile materials of its construction, weighs no less than thirty-seven American tons. Throughout her journevings up and down the length of Manhattan Island she traveled for the most part on a level keel Occasion-ally, vertical and horisontal changes were made under an easy helm and very gradually Evidently, in the early trials her commander is not going to subject "ZR-1" to the severe bending stresses, due to a sudden and extreme shift of the belm, which crumpled up the girders of "ZIt-2" and brought about the fatal disaster

During her last run, before heading for Philadelphia and home, she passed directly over the Woolworth Tower twice as far above our vantage point as we were above the street below To stand on a man-made struc ture that soared 750 feet above the earth and watch that huge fabric, big in bulk as the tower itself, swe ing majestically across the heavens was a sensation indeed! Here were the dreams of the builders of Babel and of Dedalus himself come true!

The primary purpose for which the Navy has built this ship is to act as a scout for the Atlantic fie work for which her great speed and large radius of action render her preeminently suited. Some day in the future we shall have a squadron of such ships to act as the farseeing eyes of our battleship fleet Scout ing abreast, in a line flung wide across the Atlantic and in radio touch with each other and with the commander in-chief, they will render impossible any surprise attack upon our shores.

It is no empty boast to claim that "ZR-1" is the finest airship of the rigid, or of any other, type that has ever been built. For so she should be, since within her has been incorporated all the experience of the Germans, who originated the Zeppelin, and of the British, who carried on dirigible construction in the years succe the war and made a successful round voyage from King land to America and back

But over and above this, the new design has engaged the best talent of our very able corps of naval conrs. Not only have the stresses (far more com plicated in a ship of the air than in a ship of the sea) been made the subject of exhaustive study, but every member that was built into the framework was first tested in the naval aircraft factory at Philadelphia. Finally, and greatest surety of all, the use of the everdangerous hydrogen has been abandoned and "ZR-1" is filled solely with non-explosive belium. Hence she is the first ship to be rendered immune to the flaming bullets of attacking airplanes

Pandora's Chest Modernized

UR FAMILIARITY with the wonders of radio broadcasting may not exactly breed contempt, but at least it takes away from the romance of the thing. As a fairy tale, radio broadcasting would fare quite well; indeed, the present-day receiving set in the home, bringing to the household the music and news and talks from the four corners of the globe, might well fill the rôle of the famed Pandora's chest with its never-ending flow of beautiful contents. As a reality, however, radio loses its romance as it gains in practicability and popularity. But, then, this is a practical age!

Pandora's chest-that is the keynote of radio develop ment today. When radio first came into the household as the result of broadcasting, it had a distinct laboratory touch. There were numerous handles to adjust, storage batteries to recharge, dry batteries and connections to watch after and a mass of wires connecting the various scattered components. Frankly, as a living room furnishing the radio set was disigned to upset the best of decorative schemes, and more than one fastidious usewife stood firm against such invasion and insisted that the radio set stay in some far-off corner of the

house, there to be enjoyed but not seen.

But radio broadcasting has brought about a change in radio engineering and designing of apparatus. It

soon dawned on radio engineers that the receiving ap-paratus, as used in the average household, is only the means and not the end. It is marely the medium for receiving the broadcasted programs; in truth, the average person would as soon do away with the receiving set and use a plain tin horn, if such a crudity would give the desired results. The popular demand has been for more and more simplicity combined with greater and still greater efficiency.

The answer to all this is now evident. Radio engineers have done remarkably well—almost unbelievably They have eliminated the troublesome storage battery, they have devised new types of vacuum tubes the filaments of which require a minimum of current, which can be supplied by ordinary dry cells, they have worked out simple circuits which reduce the controls to a minimum while giving excellent results, they have developed good loud-speakers, which do away with the necessity of head-phones, they have designed attractive cubinets which now contain every component of a radio set, including the batteries. The result is the compact, attractive cabinet which is invading the sacred premis known as the living room. The highest development of this kind is in the form of cohinets resembling phone graphs, containing everything, including the loudspeaker horn.

So, at last, we have the modernized version of Pandorn's chest. In the corner of our living room we have a small, attractive cubinet, blending in with the general scheme of things. We step up to the cabinet, turn a small knob to light the filaments of the concealed tubes, and another knob to search for stations. hear a faint whistle We move the knob more cau-tiously, dissolving the whistle into the strains of an We move a second knob, which gradually orchestra intensifies the orchestra strains until the desired volume of sound is obtained from the loud-speaker horn quite a while we listen to the various selections of this orchestra, coming from the roof garden of a renowned hotel 30 miles away At 10 o'clock we tune in for the ringside in a neighboring city, where a much-heralded bout is being staged between famous heavy-weights. We hear the fistic battle, blow by blow, as well as the gong, the cheers of the throng, the whistle of the timekeen and other noises that go with pugilistic activities. The battle is soon over, and we know the results several hours before the newspapers are available from the city. By now it is 11 o'clock, the local broadcasting stations have "signed off" for the night Again we ore with the tuning handle—a whistle—and then as band Clear, loud; good. Then comes the ana jass band ouncer's voice. We learn that the jass music is from a city half-way across the continent!

So Pandora's chest of fiction is now excelled by the ra's chest of fact. Once more, truth is stranger than Setion.

HERE is nothing adds to the success of a business institution more than reason. This is business institution more than proper hous-ing. This is true of governmental business institutions as well as of private conce The United States Patent Office is one of the few of in which the earnings are relatively large as co to the expense, ranking in this respect with the Postoffice Department, Customs Bureau, The Internal Reveans and similar income earning branches of our great Government. The Patent Office has a somewhat unique arrangement in that it runs what might be tarmed a large retail store, the stock of which is limited as to variety, but is almost unifulited as to quantity. This is the branch of the Patent Office that is devoted to the sain of soft patent copies of patents. Millions and millions of soft copies of patents are stored in the United States sort copies or paronis are mored in the United States.

Patents Office for sale at a very considerable profit and
the number handled each day would gladden the heart
of a merchant prince. Owing to inadequate facilities
these copies are spread all over the Patent Office Building. In hallways here, in corridors there, and in vanis

Our Point of View

rooms extending out under the foot paver cents of the city and in tier after tier rising so high as to necessitate ladders to reach the upper row Many of them are on oden shelves that increase the danger from fire and the spreading of the copies all over a large building sitates the copy pullers traveling mile after mile each day in pulling the copies. A limited quantity of metal racks have been provided but these do not begin to supply the reasonable demand. The copies are so distributed that it is difficult to promptly secure a desired copy, and this in a large measure reduces the sale, as instead of ordering copies the person desiring them will take the trouble to inspect the records of the Patent Office to avoid delay Much of this could be avoided by providing suitable metal racks for all the copies and also by providing for the arrangement of the conies in compact form and in close proximity so that the pulling of the copies will be greatly facilitated

The rooms housing the various Examiner's divisions are all seriously crowded, thus interfering with sower and adding delays where the delay is now of great inconvenience to the public, and some divisions are housed in the corridors where they are partitioned off by file cases and subject to all the interruptions and disparbances incident to those traversing the corridors.

The copies of fewign patents issued since 1914 were greatly designed in delivery by dear and when inally delivered to the United States Patent Office were delivered in such bulk that space is not available for the proper classification, nor is the Patent Office force sufficient to present the proper classification of the sufficient by the proper classification of the proper classification the proper classification of the copies, so that searches among the foreign patents are necessarily incomplete and extremely unsatisfactory

sealer in the foregoing could be swided and the Patient Office he conveniently insued and well officered, if the recommendations in the Commissioner's report for the recommendations in the Commissioner's report for the year ending December 81, 1928 and been carried out by Congress. As the Patient Office is really a business institution, serving the public and heing well paid by the public for the service readered, there appears nothing unreasonable in the desire and expectation that Congress well afford suitable facilities for the proper transaction of business which in itself is profitable to

The Navy's Contribution to Industry

HIS present agitation in favor of the complete belief into of armaments and, therefore, of our splendid Nary, is untihinking, unintermed, and exceeding springs out of an alyman size of the smblect. To be consistent, the advocates of complete distarrament about claim lass for the abolition of those police forces which enable city dwellers to work and alsep in security

In a recent fame, we touched upon this subject, and alid special supplies on the value of the Navy as a training school for our young men in habits of oreign-less and discipline, and in respect for constitutional authority. We now draw attention to the fact, so specially overlooked or inported, that the great merchant fleet which fatches and carries the products of industry is equally inducted to the Navy for the great tendential improvements which have helped to raise it to its present standard of speck, construct, reliability and high operational of the contract of

Thise the Amadamental question of ably propulsion. Less than 20 years ago the cumbersome redprocating engine was in exclusive possession of the field, both es to freight and gessnear shape, and it is largely to the casselses initiative and support of naval engineers, took here and shroul, that the world owns those two-constre improvements who then the state of the construction of the world, also, we are indebted for much experimental world in the dependent of the Dieselfendent of the construction of t

marine engine, which in economy of weight, space and consumption stands so far in the lead as to be in a class by itself.

But, although its work in developing improved means of propulsion is its greatest contribution, we must not rget that there are hundreds of other directions in which this great "laboratory of experimentation," as the Navy has justly been termed, has made generous contributions to industry. The electrically operated s, pumps, ventilating fans, and various other auxiliaries which are now being introduced aboard merchant vessels, have been in use for over fifteen years in our Navy Furthermore, the Navy was a pioneer in the use of super-heated steam , and the Merchant Marine is indebted to it for research work in developing alloys of various kinds for condenser tubes and other purposes, for its elaborate investigations of lubricating and fuel oils, and for its development on a large scale of electr cal welding methods. The Navy's model basin at Wash ington, moreover, is responsible for improved models not only of merchant ships but many of the notable steam and sailing yachts of the country. In this connection, it may be stated that the lines of not a few of the on cup defending suchts received their final determination as the result of trials in the Navy towing tank When we come to navigation, we find that the Navy has rendered invaluable assistance. To its 113 drographic Bureau, we are indebted for extensive marine surveys, and for the superb charts, issued regularly by the Hydrographic Bureau The ice patrol safeguards the passage of our great liners by locating and distributing by radio the position and course of those terrors of the sens, the feebergs. Many a good ship has been saved from disaster by the "radio compass" system, a Navy development by which ships us they are proach the coast can obtain their exact locations, even when they are shut in by dense fogs and blinding snow rms. When a ship enters the harbor channel, she can maintain herself accurately within her narrow limits, keeping in electrical touch with a pilot cable laid on the bottom through the center of the channel. Only recently we illustrated in this journal the new Navy system of sounding by sound, the practical operation of which was recently proved when a Navy ship charted the ocean floor from America to Europe in a fraction of the time which would be necessary by the old method

Nor must we forget that the Navy gave to the stell industry is Austrice the greatest single impets which it has sever received. Thirty years ago, when we began to build our first steel ships, we possessed no mills that could fabricate the heavy forgings needed for armoplate and guns. Such things could be obtained only abroad, but the Navy arranged with American man fecturers to Install the new-warp plant for this heavy work, and it was this fin-adjoined policy which started our beary steel trade on an upward vours, which, which a few years, had made us the previour steel manufacturing country in the world. So far from its manufacturing country in the world. So far from its force of the nation, a raining school for its youth, a great laboratory for the development of new industry processes, and one of the greatest exponents of the true "live and tell live" patriotium.

Advondack Forest Preserve Threatened

HE ATREMPTED raid by private interests on the Malfundack forest Preserve, by mean an amendment upon which the people of New York State will vote on November 0, State will write on November 0, and matter which affects every State in the Union, for if the amendment abould pass, it will suggest and entire and the manifer and the private-distorters against the forest reserves in other States of 8th Union.

The attack is being made under what is known as the Ferrira ausendment to section 7 of article VII of the State Constitution, in relation to the Forest Preserve. Section 7 reads as follows "The lands of the State constituting the Forest Preserve. shall

for ever be kept as with forcet lands. They shall not be leaned, said or exchanged, or be taken by any corporation, public or private, nor shall the timber thereon be said, removed or destreyed. The Legislature may by general laws provide for the use of not exceeding three per extern of such lands for the construction and maintenance of reservoirs for municipal water supply, for the canals of the State, and to regulate the flow of streams. Such reservoirs shall be constructed, owned and controlled by the State.

Thus fur the amendment follows the present constitutes It then preced to provide for private exploitation, by adding a clause which strikes at the Annalamental pathody of the present law. This reads as follows. "The Legislature may also provide by secretal follows." The Legislature may also provide by secretal source provides the property of the pr

So there you have it and for cool efficatory, in its deliberate attempt to take from the public that which the constitution has expressly reserved for its use, this proposed amendment can hardly be surpassed

For look you, whereas the present law expressly forbids the leasing of 'titte-owned lands within the Forest Preserve to any corporation, public or private this amendment is mits the leasing of such lands

Whereas the present law limits any storage lands in the Forest Preserve to the supply of water for numbipulities, canals and the syndration of streamlion, this amendment permits the building of conduits, power houses and electric transmission lines on these Forest Preserve land.

Whereas the present law provides that any reservoirs shall be operated by the State the amendment provides that they may be operated by lessees of the State, 4. 6., by private cornorations

Whereas the present law contemplates the use of water only the amendment contemplates the use of large stretches of forcest land in the form of elsarings for power houses and wide and lengthy avenues cleared of trees for transmission lines.

This latest raid upon the Forest Proserve is nothing new More than one durin, the past thirty years the Streettin American was raised its voice against the complience, as we do todas Section 7 was adopted in 1884 expressly to save the forests on State land, and from that day to this the insuber and power interests have fried to break down that constitutional safe-guard in 1886 they attempted to pass an amendment while two defected by a varie of two too to one in 1800 the form of the safe of the same of the safe of the same of th

Guly one size 1904 has this section been amended and that was when the friends of the forest prepared an amendment, which was adopted and which permits an order above, only 5 per cett of the State-owned forest land to be used for storage for municipal water supply, for causes and to regard the first supply, for causes and cit with a supply, for causes and cit wide swaths through the forests for the exerting of cubic for the benefit of private intervers. They would know the covers and the stringles of cubic for the benefit of private intervers. They would be pre-tered by fifty year leases, under which there is no evidence of the covers and the which there is no evidence to the covers and the which there is no evidence to the benefit of private intervers. They would be pre-tered by fifty year leases, under which there is no evidence for compensation to the State for the valuable rights and privileges granted.

Once more, at the forthcoming general election on November 6, the people of Now York State will have an opportunity to register an emphatic "No" to the proposal to open our Adirondack forests for private exploitation.

The Father of Our Modern Navy

How Roosevelt Pulled the Navy Out of the Rut and Gave It a Fighting Edge

By Rear-Admiral Wm. S. Sims, U. S. Navy

BW people resilise the debt we own Theodore Research for the development of our control of the development of the defense, the Navy Pew results the historical and technical knowledge he brought and the development of the d

one of the most remarkable historical narratives named one of the most remarkable instorical narratives ever written by an American, The Naval War of 1812 It shows an understanding of the fun-

demental requirements of naval effi-ciency that few officers of his time had achieved

The studies required to produce this book enabled him at once to this book enabled him at once to understand the measures necessary to bring the Navy up to a state of effi-ciency from the deplorable condition into which it had fallen by the time he became Assistant Secretary of the Navy He knew so well the qualities of material and training that make a of material and training that make a ship a reliable battle unit that when our deficiencies in these respects were presented for his consideration, he accepted the criticisms in the spirit in which progress demands that criticisms should always

be accepted, and in which they are so seldon accepted by the responsible authorities. He insisted upon a thorough investigation of the actual facts, the fixing of responsibility, and the inmediate initiation of the nec-

seary measures to correct our mistakes.

Before his efforts were interrupted by the Spanish
War, he had appointed a board of officers to inquire into
the causes of our incilicioncy in marksmanship, and to end methods of training to remedy this. After

recommend methods of training to remedy thia. After the war he found himself opposed by officers who pointed to our successes at Manila and Santiago, and who stremously objected to any public criticism of what they declared was a Navy that left nothing to be dealered in the way of efficiency of effective public of the control of the c ettner material or personnel 116 under-stood so well the conservative atti-tude of military men that he insisted upon an impartial presentation of the actual facts, and a comparison of the acrusi racus, and a companion of these with the target practice records known to have been made in foreign navies. Needless to say, the record of about one hit in 50 shots at the battle of Manila, and of one in about 30 at the battle of Santiago, showed 30 at the battle of Santiago, showed him the serioumness of the situation, and these records contrasted with the astonishing results of the new meth-ods of training in the British Navy convinced him of the necessity of

convinced him of the necessity of talking the matter in hand himself. This he did by ordering the new Pittals training methods put into operation, and ordering all gun gear and gun signic changed to make these methods possible with our guns Willian a short time the improvement was so astonishing as to be difficult to bellet. The rapidity and accuracy of belief The rapidity and accuracy of fire, the "hits per gun per minute," were increased to such an extent as to indicate that in hattle we should be able in one minute to land two tons of heavy projecties against an enemy a bull at a distance of three miles, whereas formerly we would not have been able to hit an enemy more then twice in an hour's fifting. more than twice in an hour's firing

more than twice in an hour's firing.

It was an increase in efficiency of over 8,000 per cent.

At the same time he gave his personal attention to
the question of ship design. He grasped at once the
significance of the new terrer practice records—the
fundamental fact that the big turrer guns could make a
high per cent of hits at a range at which the few high nign per cent or mis at a range at which the few mis-that small guits could make would do little damage. He at once advocated the All-Big-fun ship, the modern dreadnought, but he found, as usual that the new type was opposed by the Navy Department This opposition

he would specify have observed had it not been for a much more serious obstacle—the force of public opinion to reverse the opposition to correcting the incompersual grain as the principal betting of the control of th created by an article by Admiral Mahan advocating the small gun as the principal sattleship weapon. This made it impossible for the Congress to approve the deedmought type Nothing deserved, he instead upon an analysis of the subject for the purpose of abovering that Mahan's arguments were based upon wholly mis-taken information concerning the hitting power of but buttleship's heavy gun at long ranges. These conclusions

IN ANSWER to our request for a Norry Day message, Admiral William S. Som has written thus fine tribute to the share of Theodore Rosesvels in the upbaulding of the United States Norry. On no side of the miditalemean activates dat his penetrating mind and forceful personality work with quicker or more lasting effect. He was the despire of the resolutioners and the loop of the younger and forward-looking officers of the Norry. To his convention that nothing but the best is good cough for the Norry to soe, not english the proof growth of the Norry in size, but, what is for more important, its observement in efficiency. During the Rosesvels regime our gimenty became cough to the Norry to work to the best in the world, our whay were not of many source defects, single-coal point and the Norse-cell enthusians.—THE EDITOR.

he gave to the press, thus bringing about the surrender of the Chairman of the Senate Naval Committee, who came out strongly for the new type, which was forth-

with ordered designed.
Unfortunately the first of these ships were badly designed, and were at once criticised by Commander Key These criticisms were opposed with all of the power of the principal dignituries, but Roosevelt, as usual, inthe principal dignitaries, but Rooseveit, as usual, in-aisted upon a showdown of all the facts. He caused the whole matter to be discussed by a body of about fifty officers in a conference which he opened in person at the Navai War College at Newport. The result was

west (seen at top of gangway) returning effects call [call of Commander-leathat the defect criticals were corrected, as far as
possible in ships partly built. But, more important
eith, measure were critically are corrected, as far as
possible in ships partly built. But, more important
eith, measure were critically ship to the control of the defining one business that time the design of one buttlenings has been
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Precident Reserveit (seen at top of gangway) returning official call of Commander-in-Chief, United States Atlantic Flort, on beard flagship "Tennessees" at naval review off his home at Gyster Bay in 1994

demonstrated by the terrible turret accidents that re-sulted in the death of many of our officers and men. The consternation caused by these horrors was such that the Department actually advocated the abandon-ment of all efforts to increase the

ment of all efforts to increase the regidity of fire of our beary guns, and advised that the records of our competitive super precision should be based upon the percentage of hits to comprehension of the wholly asse-tial element of battle efficiency indi-cated by the phrase "hits per indi-cated by the phrase "hits per indi-cated by the phrase "hits per indi-cated by the phrase "hits percei-nated by the phrase "hits per-ound the indi-per minute," the standard of compar-ton a straights; letter he gave orders to be a present the result of hitther-effort to increase the rets of hitthereffort to increase the rate of hitting to put more hits into an enemy's hull than he could put into ours in a given interval of time, and he made it clear

that it was up to the Navy to risk any dangers that

such training might brovies.

But more important still than the essential changes in design and methods indicated was the change wought by the great spirit behind it all. In no line of his multiredinous activities did his penetrating mind and forevell persentality more with quietee or more and the lay of the younger and forward-looking officers of the Navy Every man on every ship, from the captain down, son resilised that there was a master mind insisting that tooling but results should count; that "the only shots that count are the shots that the count are the shots that the shot th

Navy—a Navy whose officers insisted upon efficiency, and therefore temper-ance, long before it was generally realised that the maximum mental remined that the inschingly measured alertness and manual dexterity necessary to efficiency in dangerous occupations cannot be achieved by men addicted to the cocktail habit.

addicted to the cocktail habit. This great man jarred the old-time Navy out of the complesent conceit fle well understood, and tried to make the Navy realise, that the greatest danger in a military organisation is dry rot, resistance to progress, and the substitution of a constrable administrative routine for preparation for our Me. We wan tenses there of our our. mmistrature routine for preparation for war. He was never tired of quoting the remark of a disgusted bureau chief who complained that "my department was running smoothly and perfectly until this dammed Spenish War came along and upset every-



The "Virginia" as she relied over to starboard before stating in the September, 1923, tests. Bembs that dropped aboard threw down the two lattice musts and the three smelts stacks. It should be remembered that the ship was anchored; that she had no anti-aircraft gans, and that the bombs were dropped, without interference, from the low elements not 4000 feet.

Has Sea Power Passed?

An Authoritative Exposé of the Extravagant Claims of the Air Enthusiasts

By Rear-Admiral Albert Gleaves, U. S. N.

O MUCH publicity has been given to be single performances and expabilities of alrerast as an argument against the consideration of the performance of the performance

belowies
In the July number of the Formishity Review. Mr
Archibald Hard says that the doctrine that Air Power
Archibald Hard says that the doctrine that Air Power
to the Air Po

some by the water, that thrishing out never requires would be the extinction of trade.

This is not written to discredit aircraft, but to warn against what President Boosewit would only in the substantial processing the substantial proce

should, (1) Put sterrests of the right kinds and as many as pussible on every surface skip belonging to the Navy (1) Haids all the abovers; corniver our of those discovers of the state of refuse for the Canal, for our naval bases and for our great commercial ports, navy pards, and other vital positions. If we do these things we will have done everything the air development of the day warrants. More than this we cannot do under the Treaty

When the Conference for the Limitation of Arma-ments met at Washington, the United States was on the meets neet at Washington, the United States was on the own of becoming the greeiest Sea Prover in the world, a even of becoming the precise Sea Prover in the world, a had held the trident of Neptune for 500 years, or to Japan which aspeed to low in the Far Essat what Esp-land is in Europe It will be recalled that the Confro-lated in Europe It will be recalled that the Confro-lated in Europe It will be recalled that the Confro-lated and the Confront Sea Provided as well as the sea of the Lapipane carteries, certain Lonages were also rendered as well as the size of guns. With few coreplosa, American Nivas Officers will recomber the Durlewske

American Naval Officers will renomber the Conference with a pans of revered. To the air redicals, however, it with a pans of revered. To the air redicals, however, it was the proper discussion of the other proper defense of our representations, and the only proper defense of our In overy discussion of the question the air-restination. In overy discussion of the question the air-restination in the proper defense of our properties of the properties of the particular of the properties of the prop of the United States Piec of 12 modern 80000 to 40000 to the Mattenham, and the Artification at Honolulu, by a Japanese Piect of 12 plane carriers of 10000 roas, 5 motor speech, each carry roof 1000 to 1000 roas, 5 motor speech, each carry roof 1000 to 1000 roas, 5 motor speech, each carry roof 1000 to 1000 roas, 1000 so far as may be seen now, could carry only a few bombers and could not launch asy. In the "battle the shore defences are allowed only a "few" planes and our Seet none at all except the light planes carried in the 'Langley'.

The air enthusiasts when confronted with the poor second of aircraft in the North Sea, retort "Air Power record of aircraft in the North Sea, retort. "Air Power did not appear at Jutland today; if dominates in warfare". Air Power did appear at Jutland and before, the deremans had highly developed airships at the beginning of the War and the English had stephane; if the power of th failure of his aircraft to locate Jellicoe's Fieet delayed Von Schere eight days and changed his whole plan of campaign. Air Power failed at Jutiand and in Heligo-land Hight, because aircraft could not operate in a for, hor can they now. They would have failed at Coronel for the same reason. The high speed of the battleships and cruisers in all the actions of the War—23% to 28 and cribers in all the actions of the War—23½ to 23 knots-makes it doubtful if, with their present sighting appliances, airplanes could have succeeded either in the North Sea or in the southern occans. They were of some service at the Dardanelles when a balloon was

some service at the Dardanelles when a balloon was used for spotfing the shots of the Queen Elliabeth used for spotfing the shots of the Queen Elliabeth there only because it was used as an adjusct to flee Power ALF Power and Non-Power are so interiorized and intervorons as to be innevariable. Opinions of deliricapished Elliabeth of Power are so interiorized and intervorons as to be innevariable to plants of the distinction of the property of the principal witness. It is the principal witness. It is the principal witness. It is under the principal witness. It is under the principal witness. It is the principal witness the principal witness. It is the principal witness the principal witness that the principal witness is the principal witness witness that the principal witness is the principal witness witness that the principal witness witness that the principal witness witness witness that the principal witness witness



Success ears and by one of the Army sirplemes during the 1932 tests. The heavy falling games formed a across in front of the "Virginia" and "New Jersey," readering the slape barely distinguishable in the distance

has been often repeated, "Sack the lot," but he was referring to reactionaries in the Admiratty, not to hattisohips. On nonther occasion he wrote in 1916, "I am busy scrapping parasites," ("In the North Res with leastly") again referring, not to material but to personnel Lord Plaher was a strong advocate of aircraft as usualizery to the Piete (Merodors) and he resembled better the Piete (Merodors) and he resembled to the Piete (Merodors) and he resembled resembled to the Piete (Merodors) and he resembled to the Piete (Merod

server' (Letters to Edward VII)
The enthusiant of the Air School even invoks the
spirit of Mahan in their imprechment of Sea Power In
is impossible to conceive the great apostle of Sea
Power as denying the decribe he preached for 30 years,
or looking upon super-devendanquist as "shadows of the
past," as an air entimates puts it. Could be speak on
the subject he would probably say, as he did when he
subject he would probably say, as he did when he
and the hew lawsetten. No simplies equal to the
subject he wifester tender, or of proceillast it with

a bomb of sufficient capacity, or of propelling it with such accuracy as to sink a battleship such accuracy as to sink a battleship under sure conditions is as yet in practical use, or has undergene ade-quate experiment consequently we are ignorant of the facts as to whether the results would be of a whether the results would be of a dreisive character or whether the juries in excess of that necessary to the end of warfare, the Immediate disability of the enemy, would be included in the continuous of the enemy, would be included in the continuous of the enemy, would be included in the continuous of the enemy, would be required to the enemy of the ene

telephone, and fit; odd years intervened between the fight of wooden ships at Hampton Roads and the battle of the super-dreadnaughts at Jutland It may be we are at the threshold of a new era, and the airplane model of 1980 may be an armored battleplane of 100 tons, of 1980 may be an armored battleplane of 100 teas, 12,000 horsprower and 200 knots speed, carrying fo-ton bunbs, as forescen by M Bréquet, but in the mean-tine we must be prepared to win a war with weapons in hand. The Navy, which is our first line of defense, must be kept up to the highest efficiency, equal in all respects to that of Great Britain, and five-thirds of Japan's. It is unfortunate that the Limitations Treaty

did not make this obligatory

The Bombing Esperiments of July, 1921 —The

which have started so many contro-versies, in no respect simulated war anditions and this is largely true of the tests recently carried out against the "Virginia" and "New Jersey" The 1921 experiments were postponed from time to time until the weather was clear, the sea smooth and the wind light In all 75 Army and Navy planes were used They flew low down over stationary, defenseless and abandoned ships, and undisturbed, dropped bombs of 150 pounds to 1000 ds of high explosives. In 1928 the "New Ierse," was sunk at 6000 feet and the "Virginia at 3000 feet. Toda, we have machine guns and light guns that can spray the air with simed

projecties at these elevations.
According to the report of the John Nava and Arina Board on the 1921 experiments, the practice was not as good as was to be expected under the selected favorable conditions. It is

good as was to be expected under the whole of the route o

that if our coast is protected by airplanes no ships can reach our shores or land troops" is an example of special pleading which would not be admitted in a court of law.

court of law.

In discussing this practice it should be recumblered that the difficulty of getting little with bonds or similar topodous is wastly increased when the attackers most forced in the state of the state

W E have long been of the openen that there are few deficiencies in the makeup of the average men that are so distinctive to clear handying as the lack of a of arrant moments that are being printed these days, about the doon of the bettlenhip and the dominance of the arplans. A few arplans drop bombs on an anchored and defencedas old battlenhip and, prested all battlenhip, even if they are moving writty and brattle with antisarcraft guns, are forcer helplass. With industrials facts and removated select. Advanced Clears in this article paratires the explains fallacy -THE EDITOR.

could get 5 per cent of hits when attacking against

opposition.

One of the recent claims of air enthusiasts is that altitude does not play a great part in the accuracy of bombing. They claim that with improved sights bombing from altitudes of 5000 to 8000 feet can be quite ing from altitudes of 5000 to 8000 feet can be quite accurate, in fact more accurate that from lower altitudes where the plane is under anti-curiery framfar. It is obvious that a bomb dropped from an airplane has an initial vertical velocity of zero, and bothe proposed or a shell freed with an initial velocity of 2000 feet per second. The low velocity of 2000 feet per second. The low velocity, of course, greatly increases the errors due to wind, speed of airplane, speed of target and earth drift. Nothing but the high initial velocity of grant fire can minimize those factors; therefore air beniblng affords no reasonable basis for the claim that the batteriship is donesded With the improved

tions. Also they passess that beene can go to said no the control of the control

line to protect carriers while they are launching planes or taking them on.

launching planes or taking them on.

Air enthusiast don't seem to have ever heard of this fact.

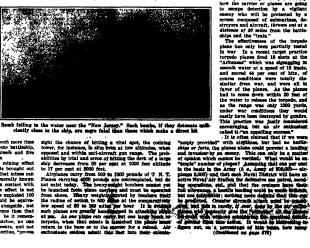
Another point that the sir radiesis never consider is the time it takes to launch planes only one at a time, as very few planes can be kept on deck ready to take off, the rate of launching will probably not exceed one in four of the minutes.

Exceed one in four of them initiates, which we have been also the consideration of the control of the seemed one of the seemed on the seem

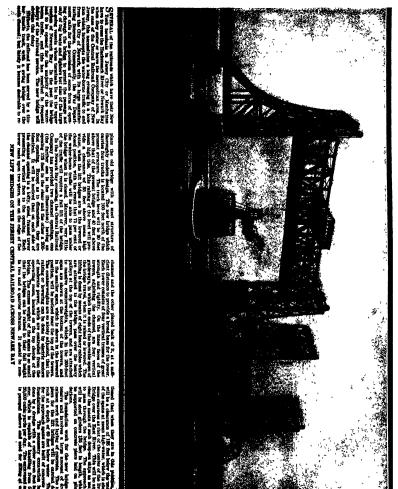
Terrodo Pletics—The minimum reprodo Pletics—The minimum reproduction reprodo Pletics—The minimum reprodo Pletics—T

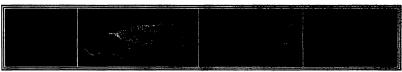
distance of 30 miles from the battle ships and the "train"

mps and the "train"
The effectiveness of the torpedo
plane has only been partially tested
in war. In a recent target practice
torpedo planes fired 18 shots at the
"Arkansas" which was signancing in



Bomb falling in the water near the "New Jersey." Such bombs, if they detenate suffi-ciently close to the skip, are more faint these which make a direct lit





emphasions that the austonical forms are smally period. Only three or four of the molds are detective, and even on these there are parts that show periods austonical detail. The or Wholes abovering hands and forch of children. The two at the right are different views of the same mold, otherwise all making molds abover any distinct

Materialized Hands

The Franck Kluski Wax Molds, and the Conclusions that May be Drawn from Them

By Dr. Gustave Geley, Institut Metapsychique International Translated for the SCIENTIFIC AMERICAN by Stanley de Brath, M. I C. E. (British)

HE STORY of materialised human mem-hers constitutes one of the most interest ing episodes in the progress of metapsy chic science. The sharp definition and pre-cision of the results obtained, and the

claim of the results obtained, and the manner of the most incontraction of the most incontraction of the most incontraction of the most incontraction in the most incontraction in the most incontraction in the most incontraction in the most incontraction. We may here remind reserve in what there excludes most inconting the most incontraction of the physical personality of the medium During transcription. m of his organism is externalized under the appearance of an amorphous substance which may be either solid or

This amorphous substance then takes organic forms, and from it or in it there appear new forms, which, when the phe-nomenon is complete, are capable of as-suming all the anatomical and physiologsuning all the anatomical and physiological characters of living organs. The ectoplasm has then become a living being or a portion of such a living being, always, however, closely connected with the body of the medium, of which it is a kind of prolongation, being re-absorbed into his body at the close of the manifes-

tation
The phenomenon is assuredly objective it cannot possibly be explained by hallucination or illusion of the experimenters. This is proved by photographs and molds taken in wax. These wax molds are specially interesting. They reproduce the exact form of the materialised member and allow the thorough examination of every detail.

The materializations being very short-lived, only a

are materialisations being very anort-lived, only a very rapid process can be used to get casts of them. The best, or rather the only known method talliling the necessary conditions, is by utilization of melted peraffin war. This method was invested in 1876, in America by Mr. Denion, a professor of fembour 7 to see the conditions of t of Geology It was also employed in London by Mrs. Reimers and Mr Oxley, who obtained excellent results. Since then as far as I know, no medium has, till intely, been found capable of giving these molds, for the very good reason that most have produced complete mate-rializations having three dimensions (length, breadth and thickness), a com-plete anniount al structure, and lasting long enough to allow of the operation of molding

For this operation a tank is provided containing puraffin wax kept at meltingpoint by floating on warm water It is placed near the medium during the seance The materialised "entity" is requested to dip a hand or a foot, or even a part of the face, into the melted wax, repeating this two or three times. wax, repeating this two or direct times.

A conting of wax is at once formed, closely adherent to the part so dipped. This conting hardens very quickly in the air, or by being dipped into cold water provided in a neighboring tank; then the hand or other organ is dematerialised and the 'glove' remains behind This 'glove' is afterwards filled with plaster of Paris, and the cast is freed from parafin by placing the whole in hot water We then have a cast reproducing the materialised organ in every

I shall here speak only of the experiments at the

JUCH reference has been mede, in psychic controversy of the past two pears, to the perafin coats of hands and foot obtained by Dr. Celey in the presence of the Polah medium Klush. We than it probable that the bare exustence of these molah has been prown to most American readers unterested in psychem tentlers. But when the Bard was in Para and saw the originals, he realized at once that no adequate account of than had saw the originals, he realized at once that no adequate account of than had saw the realized that the same tentlers of the french the accordingly arranged with Dr. Celey for a comprehensive article describing the molds, the mode of their production, and the procedure of the French mestigates in reaching the conclusion that they were genuine. Dr. Celey has sent the manuscrapt, for translation, the Act and the Polate than the same tending the condition of the State of the State

International Metapsychic Institute, referring the reader to the books by Professor Akaskoff (Animisme et Apriltiane) and by Polame (Lea Apparitions) Materialisées) for the story of the earlier experiments. Our moids of materialised human members were obtained through the mediumship of Mr Franck Kluski, during the course of the years 1920, 1921 and 1922, at first in

the laboratory of the Institute, and afterwards at

In Paris, the laboratory is a large bare room without

In Paris, the laboratory is a large bare room without windows. The doors were botted from the inside A dull red light enabled us to observe any movements by the medium. Mr. Kincki, before setting the ishoratory, turned out his laboratory, turned out his laboratory, turned out his laboratory turned in laboratory turned in laboratory in number (Professor Lifect, M. de Gramont, Count Pluccki, and sometimes Coloned Obtoleviers, set medium. Both his hands were high, to promise the coloned of the laboratory in a large bare room without the laboratory in a laboratory in one side, and by myself on the other Tha medium soon fell into trance, his head resting on the shoulder of one or other of the persons next him, and made not the slightest movement. A luminous phosphorescent cloud proceeded from his phosphorescent cloud proceeded from his body, especially from his head, organic forms appeared in condensed portions of this cloud of vaporous ectoplasm, and som developed into hands and faces hav-ing all the appearances of life To obtain moids the tank containing

of formules on developed Iniv bands and faces having the subject in a little superances of little initial presents a before the electric two faces are in the most and the mos



Two separate molds showing two hands joined

a hand up to the wrist. They are all extremely thin, the west butter only a millimeter thick and often much less. The walls of the moids were in places so thin that in fighting they developed small creats from which portions of plastice compied during the subsequent carting. We call particular attention of readers to this tensity with the complete control of the control of

Our third remark is on the delicacy and truth of the anatomical detail. Life is to be felt under these strange and deceptive casts. It is obvious that these molds have been made from living hands. We find in them not only the anatomical details but traces of muscular

not only the anatomical details but traces of muscuins contraction that can be explained only by movements directed by will. There are slight crumplings of the contract of th

operation, originals and not made from impressions."

Our certitude of the metapsychic origin of our moids Our certitude of the metapsychic origin of our modifi-nests on several proofs, some of which are shoulutely incustrovertible. First we have the proofs based on curriol of the sendium. We have stated above under chief of these—be strict holding of both his hand-should produce complete corriction. We can suffrant during the séances the medium could not at any time have used his hands for trickery. I always my self held one of his hands and am quite certain that I sever released it is Silli for there.

in the experiments at the Institute it often happened that Professor Richet I, controlling the medium, approached our hands holding those of the medium until they were in contact. Under these conditions, when we both could be quite certain, without any possi-ble doubt, that Kinski's hands were com-pletely immobilised, molds were pro-Further, as previously staduced. Further, as previously stated, we several times observed the simulta accus molding of two hands, clasped together In such cases, it would have been necessary that the medium, to make molds of his two hands, should liberate both at the same time. This was absolutely impossible As for the supposit tion that the medium could trick by making such perfect molds by using something other than his hands, this is so shourd that it does not deserve discu

rubber or any supple object. Even supposing an artificial hand artificially prepared so as to reproduce the analysis of the control of the control of the control of the control of the deleted solfs soarce outload conspict, that simulacturu could not be distincted solfs soarce outload conspicting deforming if we think courselves able to assert that It is impossible to the control of the control song sit in the harrower portion representing the wrist, so as to facilitate withdrawal, but in value All these artifices produced no result Even if we admit that others might be more skillful or more lacky than we other an inch to more skillful or more lacky than we give the state of the s

that it is not possible by using a hard object to produce paraling since analogous to our own both in respect of form and tiftnesses.

But another question immediately occurs. Can these super-normal moids he instited by using a normal invitage hand? The answer is easy it can be done, indeed there is no other frandulent process possible to the process in both imperfect and very difficult with the process in both imperfect and very difficult with the process in both imperfect and very difficult with the process of the kind of the process of the kind of the process of the kind. The process of the kind of of the ki

The first point to be cleared up is—How can these supernormal molds be indicated, using a normal living hand? We know two methods that can be used. The first and simpler, consists in plunging the hand into

skin The ice can then be left to melt and we can then get glove as thin as sired.

I do not know any other fraudulent procedure A Belgian engineer lately told ne that he had in vented a paradin sufficiently elastic to allow of a living hand being released from it, but I have in vain invited him to give a demonstrahowever, of no im-portance, for we can give a conclusive answer to the scep cal Let us take for granted that it may he nossible to make



The ludicrous result that Dr. Geley gets when he makes every effort to duplicate the seance results by use of water-filled rubber glove

cal with the super normal ones by using a normal hu-man hand. Could this process have been used by our medium? We call the close attention of readers to what medium? We call the close attention of readers to what here follows, for it is the point of the whole question Supposing the medium to have found out how to make parafin places artificially, he would have been un-able to do this during the senser. He must accessively

curing the sease the must recreasing have made them beforehand and have brought them in surreptitionally. But we are able to critis that the molds were actually made at the scances. We shall

now advance the proofs of both these

statements
The molds, under supposition of freud,
score assuredly not made during the
score, the proofs of this are numerous
and deviative. The control rendered all
complex and delicate provincents imposible. The digital imprints of the casts,
seruinished at the Preference of Police
by M Burke, the highly distinguished
chief of the Criminal Literation Berrichief of the Criminal Literation Berriice are not the finger prints of the me-dium. If it be objected that if not the hand of the medium it must be the hand of one of the experimenters, the answer is that we have frequently had the hunds of children, when there was no child present and no child could have got into the laboratory

the information.

This last argument is decisive If there be any fraud, the fraudulent molds must necessarily have been brought from outside. But the molds sere not brought from outside. They were made during the scussos itself. In order to have mathematical certainty of this, Professor Richet and I decided on two means of

control. The first consisted in coloring our paraffin immediately before the experiment. Our modes all had the exact coloration of the paraffin so prepared in the laboratory. We also decided to mix with the paraffin some substance soluble in it and admitting of chemical. test Herewith the noise of this crucial experiment made December 31, 1920

After several trials I close cholesterin. I poured five grauss of it into the warm paraffin. I tested, several times, samples of the treated paraffin, for cholesterin, and saw that the reaction was clear. This chemical reaction is well known it consists in dissolving a little of the paraffin in chloroform and adding ting a little of the paraffin in ... historouses in unsuffer matteric acid. Showly and gradually a red culor, turning to brewn, is produced Ordinary paraffin without choice tering gives no culor when so treated We had thus a sure method of verifting whether the mode were made during the experiment with our own paraffin the centimety of our senses was confirmed with mathemati-cut. The paraffinishing had been supported by the con-

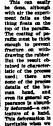
The manipulations had been made by myself alone before the sitting, in absolute secrecy. The tank of paratim was placed on the rectangular table about two paraffin was placed on the rectangular table about two feet from the medium. Control of the hands of the medium, complete, several times stated aloud Very dull red likel. Soon we heard the splashing in the paraffin and perceived the successive phases of the operation. When I judged this operation fashed, I increased the red light, and we could see on the table two molds still warm. One was the foot of a cilld, two molds still warm. One was the admirably sharp in its outlines, an (Continued on page 373 and extending up

Child's hand, reduced about one-third from the original. Here perhaps more than in any other single cast the impossibility of normal removal of the original from the nearfile appears

A second consideration is the proofs based on ex-amination of the casts. We have already shown that our molds were indisputubly made on living haman hands. This at once dispose of the hypothesis of a fraud by ald of an India-rubber giove We have ea-

dove We have en-deavored to repro-duce similar molds from an India-rubber glove distended with water, dipped into paraffin, and into paraffin, and emptied for withdrawal.
This can easily

top of the pe



warm paraffin several times and awaiting the complete solidification of the glove (which takes 15 to 20 minutes in the sir and from six to eight minutes in cold water) Then an incision is made with a rasor or sharp knife anea an incuston is maner with a reasor of sanging time along one of the edges, from the base of the fingers as far as the wrist. The hand can then be released by small lateral movements which detach it little by little from the waxen giove. The edges of the inciden are then brought together and quickly re-dipped into the paratin to conceal the joint and thus get a mold in The joint does not show much if the operation is well

The faint does not show much if the operation is well dens; but in order that it may be successful, one condition is indispensable—the glove must have 10 to 20 times the thickness of the super-normal molds. We have been unable by this process to obtain 10th gloves to the condition of the condition in the more surprising photographs shown. Also caveful scrugidy always shown some traces of the joint it can therefore be directed that this processor of the plant it can therefore be directed that this processor of the plant it can therefore be directed that this processor of the plant it can therefore be directed that this processor of the plant it can therefore be directed that this processor of the plant it can therefore be directed that the processor of the plant it can therefore be directed that the processor of the plant it is necessarily the processor of the plant in the processor of the plant is necessarily the processor of the plant in the processor of the plant is necessarily that the processor of the plant is necessarily the processor of the plant in the processor of the plant is necessarily that the processor of the plant is necessarily that the processor of the plant is necessarily that the processor of the plant is necessarily to the processor of the plant is necessarily that the processor of the plant is necessarily that the processor of the plant is necessarily that the processor of the plant is necessarily to the plant it in the processor of the plant is necessarily to the plant in the processor of the plant is necessarily to the processor of the plant is necessarily to the plant in the processor of the plant is necessarily to the plant in the processor of the plant is necessarily to the processor of the plant is necessarily to the plant in the plant is necess

our outret had not placeding insuperable obtacle to the employment. It is explored to the place of the control of the temporal of the control of the control of the control of the content in wring the heliow model of a human hand into this mode access white most can used the ways. both faults and activity, in posreed, When solidified it is the placed to a tank of cold water and shet till the cast dissolves and the giver remains. An improve-ment on tiss, we have been teed of your horizont of the position of the control of the control of the control of any control of the control of the control of the super-frozen its interesting it is super-frozen its in two obtained. It can be quickly plunged into melted parafilm and a very thin glove is

An exceptionally fine soult female hand, on which the parallin shell is no thicker

The Animal Hospital

Surgical Treatment for Horses, Cows, Mules, Dogs, Cats, Goats, Canary Birds and So On By William A. McGarry

OBASE, even and make can now be given
supplied terrainers for timons, warped
arrangitis, rupitares, broken bones, sevens
laryragitis, rupitares, broken bones, sevens
laryragitis, rupitares, broken bones, sevens
laryragitis, rupitares, broken bones,
laryragitis, rupitares,
large large large large large
diseases that formerly made it necessary
performed every week day in the year, not only for the
purpose of perting information converning rure diseases

purpose of retting information cancerning rave diseases that may be of value later in retenting human beings, but to save and peolong the lives of the animals and to increase their meritimes. And the sume their apply to the control of the control

evolved, after several years of experience and after all existing apparatus had been found unadaptable to the peculiar needs of the veterinary surpress. The table when not in use looks like a section of iron wall backed by leaning bursers. It is obten, and while standing on its side its width is a little more than the height of the fallest horse At one end there is a projection to serve a minimum of the control of the cont on may be made fast to it. The procedure when an operation is to be performed to quite simple. The animal is walked to a position beside the table, which stands on its side. He is strapped securely to it and a hindfold is placed over his head. One of the surgical assistants turns a lever or the surgical assistants turns a lever that sets in operation an hydraulic appar-atus, and the table begins to tilt over-carrying the horse along In a few seconds the animal is on his side, resting com

formore assistant then goes to work with the amersheic, using exactly the same methods as he would on a human being except that the apparatus is larger and specially designed, and more anaested.

atus is larger and specialty designed, and more anae-thetic most be used In operations en human beings it is customary to start with chine-form and then after the patient has been assumed to the designed of the patient has been assumed to the done because either has a sickening effect, although it is not as hard on the heart and therefore not as dangerons. Horses, however, are simpost immuno to either It merely exites them. While it might be possible to reache them unconsiderately using enough of it, the surgeons prefer chloroform, and a quart of that potent stuff is required as a rule to get a horse ready for the knife

al anaesthesia, however, is resc to only in case of a major operation. When the injury to be treated is local, as in the case of a surface tumor or abscess, procase of a surrace tumor or ansecess, pre-crine, nonocaine or some other of the recently developed local anaesthetics are used, and lobbin newer knows that he has been all cut up until long after he has reached his stall, when the effect of the drug is beginning to wear off. When the drug is negiming to went on when the operation is completed the table is titled again. In the case of a major opera-tion and total annesthesia, the apparatus is stopped at an angle of 45 degrees, and is stopped at an angle of 45 degrees, and a heavy steel hand truck also designed by Dr Adams, is run alongside. The straps are removed and it is then possible to slide the horse on the truck, which is wheeled



to the floor of his stall with minimum disturbance.

Although this table has been in use only a few weeks, it has proved already to be one of the most



Students at the Veterinary School of the University of Pennsylvania inspe

valuable adjuncts to veterinary surgery Heretofore all sorts of expedients were used in serious operations on large animals. Bometizes they were performed while the animal, unconscious, isy on the floor. That



made it necessary for the surgeons to kneet. As elsestimes holesting rackle was used to fift the heres to a table. The datager these lay in the indays that sightly the sightly have been as the sight of the sight o

until the hospital is perhaps the finest of its kind in the work as done it was the Its cut of the start size of the war the Its cut of the start size of the start of the start of the start of the country that is not under the start of the country that is not start of the country that is not official in a year, six of which were successful. The task is are difficult than in regalified fractures of human bones, since in nearly every case considerable these starts of the start of the

ing Seltwood to Make It Hardwood

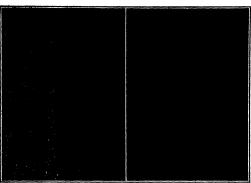
District visits has been developed in Heller It industry which may bring about enormous a tions in the emblyation of hard—morning about enormous a new comment.

It industry which may bring shoul morrous altera-tions in the exhibitation of hard woods. It has been possible to convext soft woods, by presents, into hard with the convext soft woods, by presents, into hard White can both at a pisoe of wood in arous section, one that all kinds of fibers and bundles of fibers so-could gravitles. These certifies are assential for the life of the pints, for they see to the treaster of water when the plant is field, however, and the wood is going to be used, then these certifies are an unfavorable cir-cumstates, because they lower the value of the wood. It is float plant the quantity of fibers which greens the number of fibers, the softer and more easily spall it is the value. The more cavifies there are, with regard to the mamber of there, the active and more easily spit in the market of the cavity and the c

When a piece of wood is subjected to a uniform high

centry been realised in a technical way. When a piece of wood is subjected to a uniform high pressure, along with a high temperature, the above-pressure, along with a high temperature, the above-pressure, along with a high temperature, the above-pressure most, of course, be applied to called a single size of the pressure medium. Water is invoked to the pressure medium, which is a legisle as the pressure medium, which make the medium high size of the pressure medium has been found in asphalt, which only just pensions that the pressure medium has been found in asphalt, which only just pensions that the present of the pressure medium has been found in asphalt, which only just pensions that the present of the pressure and the press caramel can occur, which causes a darkening in the

color When the wood is pressed, the outer layer, into which the asphalt has prescrated can be sawn off, and then one can cut it up into whatever pieces of lumber are desired. These pieces consumer a very beautiful marking, since the layers, already pressent in the wood, are now much



Cross sections of a piece of elm, showing (left) the wood in its natural state, with large cells, and (right) compressed to make it limostone, with hard wood characteristics

closer together It makes a magnificent shining polish. Up to the present, lignostone, as the product is called, has been chiefly fashioned into golf clubs, loom bobbins,

walking sticks, and inxury articles, but especially in the domain of inisid work does it promise a good future. It is easy to understand that the natural hard woods in the future may experience a strong competition from

Angelique-A Wood that Besists the Attack of the Teredo

PROM tests recently conducted in Dutch Guiana, it appears that a wood has at last been found which is immune to teredo attack. This wood is Angelique (Dicorynia parasanis Benth), which is said to ove its teredo-resisting qualities to the presence of fine particles of allies in the fibers, which act as an abrastro on the boring apparatus of the molliusk Physically, Angelique is a dark brown, heavy wood with a specific

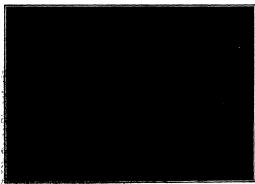
gravity of 0.851 when freshly cut and 0.746 when thoroughly dry amblyed to rigorous tests in the lock gravity of the property gained much publicity during the building of the Panama Canal, as it was selected as the best wood known at that time for use in lock gate construction, in waters infested with linnoria . It was not long, how-ever, before it became apparent that greenheart was ing rapidly destroyed in the Saramacca Canal, and the Dutch Guiana government undertook to find, if possible, a local timber having durable qualities that would builte the teredo

Among the great number of woods experimented with was the native Angelique which after five years service in a particularly badis infested locality, was, for all practical purposes, found to be free from attack, while the greenheart placed under the same conditions was utterly destroyed within two years

Angelique has been used since 1915 in Dutch Guluna by the local railway company to replace imported teak in the building and maint nance of railway cars. When properly dried it answers the purpose exceptionally well, although it has the disadvantage of being harder to work. In all places where toughness and resistance to work In all places where toughness and resistance to abrasion are required, it can be actely recommended. Amedique is found in large quantities in the eastern half of the province. Specimens six feet in circumfer-ence and 60 feet clear bole are common while trees as great as nine feet in circumference and having a full ninety feet of bole are not exceptional

How to Make Lime Set Quickly

SOME months ago the Bureau of Standards developed a quick-setting lime composed of one volume of ground quickline and two volumes of hydrate. The ground quicking and two volumes of hydrace. The commercial success of this material depends upon find-ing some way to make it keep during shipment, or else to make it into finished form at the factory. Working to make it into minned form at the factory. Working on this latter phase of the subject the Bureau has been developing a cast lime partition tile. Experiments have shown the best composition to be one volume of wood fiber, five of quicklime and ten of hydrate, and wood mer, not quexame and ten or naturate, and that the best curing condition is outdoors exposed to the weather Such a block sets so that it can be removed from the mold in ten minutes, can be handled in twenty minutes, can be sawed and nailed, and has a compressive strength of 100 pounds per square inch at seven days. It is about 20 per cent heavier than grysum tile of the same size, and experiments are now being conducted to see if the core volume can be in-creased without too great a sacrifice of strength



Biblioms of the build-residing qualities of Angelique (shewn below) compared with groenheart (shears). Buth mostle wave subjected in five years' immercion in the same legality. The coin is about the sixe of an American quarter

The car is placed 25 feet from the test across that is used to diagnose the ills and evils of headlamps which have gone wrong

OOORDING to investigations made latterly by national automotive engineers, automobile headlights on 19 out of 20 motor cars are defective to the extent that they jeopardize the life and limb of other autoists who meet and pass them

other autoties who meet and pass them lecently. These Sam's official representatives tested out the headilghts of 400 automobiles in the District of the Columbia—these cars were very riped; of the guerral country—and found that 16 per cent of them were ountry—and found that 16 per cent of them were on ingerfect in one way or another as to endanger the metry of the operators and other motor or owners. In this sky and ugs when most of the States—where automobile traffic is heavy—there where a traffic is heavy—there where where the traffic is heavy—there where the traffic is heavy—there where the h

out of every 20 sets of headlights violate State regulations through the carelessness State regulations through the carelessness of the car owners and drivers, is autounding. In the arts and industries, we are constantly reading about the formulation of new antety codes for this or that trade. The resources of actence are yoked to the task of taking the doubt and danger to the task of taking the doubt and danger out of hazardous occupations. And at the same time, we motorists, as a class, through sheer neglect are promoting a meance in highway travel by forgetting to maintain our automobile lamps in the most serviceable and efficient condition

most serviceance and encernt continues.

The results of the headlight search and research are startling to most of us when we understand that 73.2 per cent of the lumps tested were out of focus. You know how it feels to be driving along a

show now it recis to be driving a dong is slippery, skiddy pavenent some black, rainy night and all of a sudden to have an approaching car sinuce bland you with its powerful lights whose beams have gone astray due to the neglect of the owner if the figures are impartially representative—there is every reason to believe that they are—you may expect to be nearly blinded by the unsatisfactory lights of 73.2 out

he newity bittoked by the unseitefactory lights of T3L cost of very 100 motor vehicles that you must. These farts and figures are astounding snough to keep timid motor in the contract of the cost of correctly tilted 40 per cent had dirty, rusty or dented reflectors, the lenses in 85.8 per cent of the cars were twisted in the headlamps, while in 23.6 per cent of the

twisted in the headlamps, while in 23.6 per cent of the cases the headlamps were not parallel.

Dirty leases and reflectors simply reduce the average efficiency of the headlamps. However, they become dangerous when they do not transants unificient light to the roadway to make driving safe. Readlamps hat are not parallel are extravagant profiliates of light, any which should be reflected down the road serve only rays which should be reflected down the road serve only to illuminate the sarrounding scenery. Lack of focus, twisted leaves and lamps tilted upward result in a waste of light and throw a bilinding gine in the eyes of the approaching driver. Headlamps that are tilted too far fewars light the her way or only a short distance in front

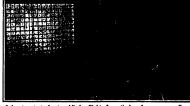
Why Headlight Glare?

How Uncle Sam Tested the Headlights on 400 Ordinary Motor Cars and What He Found

By George H. Ducy

of the car They produce a narrow zone of illumination about 80 feet deep extending from 20 to 100 feet ahead of the car, depending on the de-gree of light. When corrected,

seed to dispusses the Illa was seed little terconfiler from all wrong feet in Tened of the care to 250. Study of the recent survey feet on more fown the read. Better his more creat shows then taked to Illa effect of the least of le



Laboratory test of automobile headlights for optical performance as well as
for electrical dismaing devices

general driving public require direction and education more than in this simple little matter of least pulpose, more than in this simple little matter of least pulpose, driving them in turn into position about 25 feet from a special serven on which was drawn a horizontal line at the level of the lamp (aspect 56 lineshs) and two weet-cidents 25 inches). The lapsementions of these wertical lines with the horizontal labor approxement the projec-tion of the centres of the lamps to the screen along a line parallel to the surface, 38

line parallel to the surface as which the car stood. The lamps were focused and the lennes properly pointed so that defects in the position of the lamps couried. When corrected, When corrected in the lamps would have a surface to the lamps with lamps would have a surface to the lamps with lamps with lamps are borisontal. State which strikes the horizontal line would never reach a level which strikes the horizontal line would never reach a level road. Light falling slight inches below this line hits for roadway about 235 Sect along white rays striking 18 inches below the line illuminate the highway at a distance of sp

highway at a distance of Sp-fact from the ear Adequate gutter litumined tion is secured by light that strikes the screen two feet to, the side of the vertical lines and nine inches below the borizontal line. In order to

obtain some light above the pavement as a protection against overhanging follage and limbs, the pattern should be no adjusted as to appear slightly above the horizontal line in the center only A space in the upper left hand sector about five inches above the horizontal and the same distance to the left of the left-hand vertical and the same distance to the lart of the left-shall vertical line intercepts the light which would probably reach the eyes of an approaching driver 700 feet away This light, if amficiently intense, is known technically as "figure." Special care must be excreted in adjusting issues to see that none of the predictal beams fall within this

Fifty-seven different makes of headlights divided into Fifty-seven different makes of headiliths divided into three main classes were tosted out in the recent Washloaton survey, the Brosses of Standards superis Strainshifts and the Standards survey, the Brosses of Standards superis Strainshifts and the Standards survey, the Brosses of Standards superis Strainshifts and the Standards survey, the Brosses of Standards such survey of the Standards survey of the Standar three main classes were tested out in the recent Wash ington survey, the Bureau of Standards experts furnish

Uncle Sam's representatives believe that future (Continued on page 374)



Another view of the equipment used in testing automobile heafflights. Noti the awaying support and the classes for helding different bissess



Components of the new recharger and its complete assembly First, looking down into the recharger case, with chemical cell at right. Second, the electrode of balkite metal. Third, the transformer and its connections. Fourth, the wooden case, with fins of chemical cell left parily exposed

A Fool-Proof Recharger for Storage Batteries

THERE has lately appeared on the market a new I type of storage battery recharger, which now takes its place alongide the wheating type recilifer and the vacuum tube rectifier, for use in the home and private garage. The latest recharger is a chemical rectifier, complete with step-down transformer and leads, so that it may be readily connected with any 110-volt alternat ine-current supply

inaccurrent supply
The action of the intest recharger is dependent on an alloy called "belittle," which is a form of the element tastainm. The meterial forms a don-way valve when introduced into certain acid or alkaline electrolytes, allowing such half of the alternating current wave to perfect the supplied of the control of the perfect of the control of the perfect of the control of the contr of the wave. In the commercial type the mannard storage battery electrolyte is used in order to simplify care and maintenance. Furthermore, the recharger con tains a two-winding transformer which allows the re-

tams a two-winding transformer which allows the re-charger to be used during the operation of a radio set, without any danger of blowing out vacuum tubes. The new recharger is of compact dimensions and next appearance. A sturdy wooden case contains the trans-former and the chemical rectifying cell, and provides space for the battery leads and plug connecting cord. The recharger is virtually fool proof. It is entirely noiseless in operation, while a small red light, which may be viewed through a window in the transformer compartment, indicates when the recharger is working. There is nothing to adjust. It requires no attention except an occasional filling with distilled water. It can-not fail to charge the battery, and it cannot discharge the battery even when left connected. It cannot short circuit. It delivers a taper charge which decreases as the battery becomes charged, so that damage through overcharging is impossible.

The writer of these lines has found the recharger

The writer of these lines has found the recharges entidactory in every way, after prolonged tests with six-wit storage betteries used for radio work. The storage betteries used for radio work. The storage constitution of the recharge of the storage of the stora

main attached to the battery without danger of discharg-ing it. The chemical valve will stand a back pressure of 250 volts before it allows current to flow through in the wrong direction.

the wrong direction.

A Binding storage battery
manufacturer has recently
incorporated this recharge
in a deingact unit together
with a storage battery. Thus
in a single wooden case,
the redde nameter is senared
a refinble source of filament
current ep place current, or
both, without the tread maitiplicky of apparatus and
the bether of connecting up.

ctric Heat for the Type-Metal Pet

I is well known that all hactypes, intertypes, mon-

machines have melting nots in which the type metal macanass have neeting jobs in which the type ment is kept motion through the application and maintenance of sufficient heat. However, it is not generally known that the heat must be just so for satisfactory type casting, and that it must be maintained at such critical nperature within very narrow limits.

Gas is ordinarily used for the purpose Electricity, which has been gaining more and more ground of late years, is considered a decided improvement on gas. On Jestin, is cimalered a decided improvement on gas. On its face it would seem to be the real solution of an even source of heat, but in actuality there are several treu source of new, out in actuary torks are several troublesome factors that indist on popping up the of these is line-voltage fluctuation, which causes a marked fluctuation in the type metal temperature and consistency, thus hampering the operation of the type-catting device. The average electrically beated metal pot requires anywhere from 2,000 to 2,800 watts of energy, which is a strain on the average electric light

The latest developments in this field take the form of the squipment shown in the accompanying views. A vibration thermometer is incorporated, in which the distance of travel of the pointer has been limited to onecostance of travel of the pointer has been innuced to meet eighth into The pointer is held constantly under spring tension against the positive contact. As the heat in creases, the pressure against the pointer is built up until the apring tension is overvome and the needle until the spring tension is overcome and the neccile scape positively from one contact to the other. In cooling, the reverse operation takes place. This posi-tive action insures perfect contact and the sensitivity of the needle is increased the more the machine vi-brates. The actual contact end of the needle is a loose brates. The actual contact end of the needle is a loose roller which must travel around a high point in moving from contact to contact. This automatically turns the roller on the spindle, and presents a cleanly scraped contact surface to each movement control insures a temperature regulation of 25 degrees on the operating machine, and 80 degrees on the idle

A chemical investigation made at Columbia Univer-sity proved that there is a critical temperature of

type metal. Between the limits of 750 degrees and 1000 degrees F, and in reasing directly as the antimony content increases and also increasing directly as the temperature increases, there is every decided action of the antimony on iron. The affinity of antimony for iron causes great activity of these two metals within these limits. The cleanly finished surface of iron or steel will be attacked at once, and in the case of thin sheeting will be attacked at once, and in the case of thin sheeting the walls will be penetrated

the wain will oe penetrated.

This was exactly the case of the immersed heating unit. The units were made of channel from and presented an ideal surface for this action. The space between the heaters and the walls of the crucible would. gradually become clogged with dress which acts as a lieut insulator. The temperature of the metal in this space was naturally higher because the outside heater was also radiating heat in this direction This natural, excessive temperature was very much increased by the above-mentioned accumulation of the dross insulator, which hampered the conductivity of heat from the unit

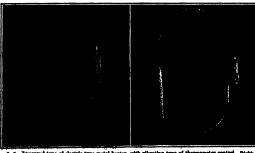
The melting point of the 1446 degrees F, bead 620 degrees, and anilmony 1190 degrees. When these metals are mixed, the melting point of antinony is lowered are mixed, the melting point of antinony is lowered are mixed, the melting point of antinony is not noted in the case of the contract of the contr action of the antimony on the iron channel shell. This shell, therefore, has often been attacked, penetrated, the metal sceped in and the unit was short-circuited.

In the course of scientific research to establish the

action of antimony on iron, it was also necessary to find an element which hindered

this action Of all the tried, the most effective and most economical was found to be the scaly surface on iron qustings. If this sur-face was penetrated by filing or machining, the action was

The nichrome wire heats were inclosed in drawn ste tubes. It was necess manufacture these tubular units so that they could be immersed in molten from at 2300 degrees F., and allowed to remain there until solidification without fear of melt-ing. The danger of explosion, due to moisture within the tube, was also acute The manufacture of suitable units has now been successfully accomplished and the tubular beaters are covered by not less than one-eighth inch of east iron. It is impose for the antimony to pene-trate this construction and the heating of the type metal is at its best



Left Improved type of electric type motal heater, with vibrating type of thermometer control. Rights
Internal details of the vibrating thermometer

A few of the pailing winches within the mer shed



HEN the Bruzilian passenger steamer 'Avare' was leaving the dock last year with double bottom tanks only partially filled she capsized for want of sufficient stability and caused the loss of 99 human lives In its wrecked position the ship which was lying between

to shipping A quick salvag ing operation therefore was anded in the interests both of the owners and of the Harbor Authorities

The vessel with a tonnage of 8227, has a length of 418 feet a breadth of 56 feet and a depth of 38 feet | She was formerly owned by the North German Ll vd under the name Sierra Salvada but by the Peace Treaty of Vermilles she was transferred to the Brazilian Gev The Vulc in Works of Hamburg undertook the salvaging work their large shipbuilding yards hin, situated very near to the place of the accident.

boats with some greater complications also on the German liner "Gnelsenau

German liner 'Gness nau sunk 1914 and salvaged 1917 in the River Scheide near Antwerp and on the Ameri can passenger ship 'St can passenger ship '9t Paul which capsised and was salvaged in New York Harbor This was done by raising about 12 triangular treaties on the port side of the hull which was strength ened by longitudinal girders. Then these treaties were connected by means of tackles to fixed points on the pier consisting of driven piles. The tackles were then pulled by steam winches until the ship was righted. After before without the could

ing righted the ship could be ballasted refloated and towed to the dock In spite of the simplicity of this method, extensive preparations were required on the part of the shippard Trestles 85 feet high were constructed riveted and erected

on beard by means of the Vulcun slarge floating crane As the structural material for this w rk could be taken from the vard's stock the whole work was finished within a few works. All the trestles were cannected 15 orisontals and diagonals orming a rigid frame work

At the same time large sand bottom of the quay shed by means of two steam drivers used for building work Altogether, 182 piles of 85 feet length and 18

Righting a Capsized Ship

Successful Righting and Setting Affort of the Bratilian Steamship "Avare" in Hamburg Harbor

By Dr. M. Probet Marine Engineer

inches diameter were required. They were driven in groups of four or six, foreign 30 fixed points for the 30 groups of four or provided the second of the se There were also eight floating winche with its own boiler on board. These were me quay below the main tackles

In spite of the difficulty of working under write, bodie of the ship badew the hird defer were notes no substituted that the partiality sounded by powerful par-ent hourd of the salvage burges. The weight to lifted was by this means redound. A further disalen-ing of the required righting moment was gained dardging a trench below the startourd high look, it that the centre of rotation was displaced about so feet nearer to the center of gravity.

root neares to the easter or gravity.

As a considerable reserve or litting power fifther and hardest period of litting, four satings in and the floating crane of the Vulcan shippard moved to the deck side of the capsised vessel.

exerted a lift of 500 tons. The total truning me realised with the desams, was 125,000

Near the middle of Augus all the preparations were finished, and the navigable maised, and the navigable water, hitherto used by ship-ping was shut off, prepara-tory to stretching the strel ropes of the tackies between ship and land. The valves

ship and land. The valence on the steam pipes lander on the steam pipes lander from the tugs were opened, the winches teated, and the feature of the ship were drained as much at possible by pumping, the ship was described by t

soli at ful power In as few disches began to stip was observed the error time a small lifting of the sinch by inch the superirecture was raised out of the water. The turning was continoed without interruption until the inclination of the same of the same and the sa

used in the holds, with the result that the list of the ablp was further decreased. All the water above the sand bullest could now be removed by pumping, at issue from the holds, while the engine rooms were set; isoded until the other compartments

until the other compertments were emptied.
On September 7th this bal lasting and pumpyork was finished and ultimately the pagine and boller rooms were pumped out, until the phip



The capsared "Avara," with 12 steel treaties erected upon her side for attachment of the pulling cables

pilet of the accident.

If the control is a control is a control is a control is a control in a control is a control in a

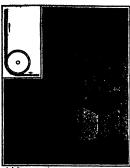


This shows, left to right, the pulling winches in the pier shot, the cables, the capsined ship with the

diameter connected by fiertible hoses were conducted to the battery of winches. Similarly exhaust pipes were arranged parallel to the supply pipes, exhausting out of the shed upwards into the open air.



The skip partly righted, ready for the final pumping and feeting



A belt-conveyor for messages which works on a novel principle

Something Different in Belt Conveyors

O's decidedly unusual design in the bit conveyors

O's decidedly unusual design in the bit conveyor recently installed in the Berlin trunk line triephone evaluages it takes the pince of the flat-tube
presumette mail installations formerly in use for the
transmission of order slips. The new beit conveyor
comprises a bott passing along the trunk line record
tables and is based on the fact that the friedring cosm

transmission of outer single The new foot convey or tables and is based on the fact that the friction coefficient of paper on metal is only hait as much as that of paper on the father. The order beliefs is allipsed appear on the father than of the belief the single paper on the paper on the father. The order beliefs is allipsed serving to guide it and, on account of the greater friends, adherent on and moves along with the belt Immanus as he same achieus would seem to land titled to many large quantities of sitters, sithy and other light objects, it is of move than passing interest. The paper of the paper is the paper of the paper of



A new machine which may revolutionize the

The World's Largest Gasket

The World's Largest Gasket has, it is AERICAGO mannfacture of gaskets has, it is AERICAGO mannfacture of gasket than any in the world, and as this concern is the largest gasket than a newfle, and as this concern is the largest gasket mann facturer in the world wash a consummation is quite inside and a Dil 11 feet in its greatest diameter this manmost gasket required, in order that it might to best advantages be preed for a photograph, the supposed of three ness, one standing well up on a lofty seep ladder the control of the preeding of the manufact of the control from the preeding would require a good bit of a freight car

Directive Radio Transmi Length of 10 Meters

Length of 10 Meters

UNTLI recently radio communication was for the
Unnot part carried on from a transmitting station
communication. There were only a few special index
of service, such as time and weather signals, which
or service, such as time and weather signals, which
were transmitted from a sending station to any considerable number of receiving stations. However, even
in the coals of "joint to point," communication radio in the case of 'point to point' communication radio signals were sent out in every direction and could if desired, be received by my station within a certain distance regardless of its position with respect to the transmitting station. Since the total number of mes-sages sent was small a comparatively small number of wave lengths was sufficient to take care of traffic re-quirements. With the divelopment of radiotelephone quirements With the dx elements of radiocisylmout crammitting apparatus. The broadcasting of voice or made by radio has nexumed an important perition and was been appeared to the property of the property of the wave lengths than the sharp waves used for radio rele-graph signals. With the greatly increased tradio and the much wider band of wave lengths which it or cupies, considerable interference has dx-elemed among broadcasting artifacts and lost week brando using stations to the property of the property of the property of the producting artifacts and lost week brando using stations

irondensing stations and however bread outing stations and radioteleraph stations and radioteleraph stations. There are two wave if reductions and interference. There are two wave if reductions and income and the sarrow beam toward the receiving station and to employ in such transmission shorter wave knock in the many large and in the process of the sarrow beam local. In Radiotal Investigations have been made of directive short wave transmission and it the literator of validation acceptances have been made of directive short wave transmission and it the literator of validation acceptances have been and at the Bureau of 3 indicate experiments have been conducted on transmitting apparatus complosing else-conducted on transmitting apparatus complosing else-waters and emplose waxes as short as 10 meters. In these experiments a nrife tor has been used on advance of short parallel, verite it wires arranged on a frame of short parallel, verite it wires arranged on a frame for short parallel, verite it wires arranged on a frame of short parallel, verite it wires arranged on a frame of short parallel, verite it will be some way to be same way as the mirror for light waves. Forty vertical wires were used and the generating set with te small antennas was placed in the force of the para its small antenna was placed in the focus of the para-bola, each wire was turned separately to 10 meters by adjusting its length, and it was found that about 75 adjusting its length, and it was found that about 75 an angle of approximately 75 deeperse. This apparatus is de-vribed in "cicrafte Paper of the Bureau of Standards No def and can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. O., at 10 cents n copy

Fatigue Tests of Limestone Patigue Tests of Linescone
As noted hat ment the Brevau of Standards is
extent strone will fatter under a castinuards
extent strone will fattere under a castinuards had the
predimens are prepared in the form of beaum which
are supported at the ends and have a load suspended
to the store equivalent to tree-third of the ultimate
strength Defection measurements are being made at
interval to determine it (there is a continuous sagning, which, apparently, is the case according to m ments which have been made to date

Dressing a Codfish Every Second

Dressing a Codish Every Second
OTT on the forgy Grand Banks the most ardroom
Everyone dreads if, for it measure working regardless of
hours until the job is done. If the excita has been
fours until the job is done. If the exist has been
cuting crew hard at it by the light of flares. No one,
not even the cook, commonly known while shoat as "the
potent," may have any rengits. The deek is slippery
with pers of the thousander both that the been fall
potential to the control of the control of the
second of the control of the control of the
second of the control of the control of the
second of the
secon



An eleven-foot metallic gasket

of 00 to 75 men who now wield sharp knives on the Grand Banks off Newfoundland up along the Labrador as well as in the localities frequenced by fishermen from France Lagland and Scandinavia Every second the new methics takes a feeth codibile and as often it turns out a dressed fish. It performs all the usual operations of splitting removing the backbones cleaning and washing This ingent us machine was perfected in Seattle Washington by the company which perfected in 1905, a somewhat similar machine called by fishermen. The Iron Chink because it took the place of thousands of Chinese who were formerly employed to clean fish in the salmon canneries of the North Pacific

More "Talking Lamps"

MOTORISTS who pass through Nonkers N Y at night will find a device installed at the intersec-tion of five principal streets which not only enables one tion of five principal streets which not only sendisc one policeman to control the heavy motor and street car policeman to control the heavy motor and street car saxyed officers who were frameric ratificed at this in teresticin sur able to do. In the photos, much the three boseons in reset the cumera revolve while the one boseons in reset the cumera revolve while the one boseons in reset the cumera revolve while the one boseons in reset the cumera revolve while the boseons in reset the cumera revolve while the entire group of boscons. By pushing a bottom on the side of the distant boscon he simultaneously enemies side of the distant boscon he simultaneously enemies side of the distinct beacon in simultaneously revolved the other three beacons and of which bears the usual "Go' ind "stop as well as the corresponding green and red lights for night signalling. In addition to these sizands there is a group in such beaton which automati-cally rings as the top turns thus giving, an audible as well as a visible signal.



A remarkable group of four traffic beacons which is controlled by a single officer

NCE almost a century the

INCE about a century the world has been dependent upon Russia for the flax tupon Russia connote high quality

connote high quality
Treads its ryting to improve the quality of her lines
still further by improving the flax plant from which it is
no delated. But quite the own of the second of the control of the c one thinks of Russia as a visat expanse of and, the critise only secondary Ireland was put to it to compete, for land in Ireland is source. There a nobleman's exists, kept primarily for hunting during a few weeks of the year, might monopolise as much land as a hundred pensants would need in order to support themselves in pesantis would need in order to support themselves in simple comfort by ruising fits. Even harren, neely hillides have been literally carpeted with a keyer of the control of the control of the control of the control backs of patient pessants. How could Ireland, thus handicapped, compete with houndless Bussia? By ruis-ing not more, but better, fits. And so while the Roussian neglects the evolution of new strains of fits there the Irishman organism the Irish Lines Research Institute at Belfast. Kwen before the Great War, during a decade the Russian yield had

Improving Irish Linen

been dwindling, jet so great was the remaining total production there that flax could actually be sold to the Irish lines manufacturers at about \$150 per ton. Is it, then, a wonder that the real-racked Irish farmers, fac-ing such competition, gradfellig gave up growing the cropy. Lastead of 100,000 access their acreage has falles

to 20,000
Today, of course, Russia exports but a fifth of her hundred thousand mas of flax to Ireland of the prevent days. By this hopping off of the Russian supply the price has been boosted to about \$200 per ton. How, then, to make first growing profitable to the Liou, then, to make first growing profitable to the District that the problem which the Irish Lines Research Institute is tackling. At the octace, two main resending suggest themselves—improving the yield of flax per acre and improving the quality of the fiber for spinning. In order to increase the yield per acre efforts are being made to grow more flax plants per acre, to increase the size of the individual flax plants and to increase the size of the individual flax plants and to receive the size of the individual flax plants and to the contract of the contract of the plant itself.

Itself
One apparently simple way to grow more plants per
area is to sow more seed. Nature rebels—the plants resulting are spinelling. Threefers lif. Searis, the result must be accomplished by breeding tailer plants.
Simultaneously the plant breeder vill work for a larger
proportion of spinnable fiber per stem.
If grains is the art of taking plants the work done at
the Research Institute is gesting aspit in capitals, Barly in
the month of May art to depth thousand useds are

per form, each carefully planted singly and on att-med market, such wave, "Fem and on att-med market, such vary. When the scene resorts in laught of this inches such is clear year to be a faught of the inches speak and the scene resorts in laught of the inches pears each single plant is excitationed, in bideous is repaired in the second of the scene and the scene and the scene and the scene are such as a scene and the scene are inches and the scene are inches of the universal part of the size, in disnesses, and the extent to which it has side braughts. Precious of the universal to secure are inches and the scene are inches the scene are inches of the scene and other data. From these and other data what is called the 'confident of corrected and other data what is called the 'confident of corrected and other data what is called the 'confident of corrected and other data what is called the 'confident of corrected and other data what is called the 'confident of corrected and other data what is called the 'confident of corrected and other data what is called the 'confident of corrected and other data what is called the 'confident of corrected and other data what is called the 'confident of corrected and other data what is called the 'confident of corrected and other data, what is called the 'confident of corrected and other data what is called the 'confident of corrected and other data when it is a support of the corrected and the 'confident of corrected and other data when the 'confident of corrected and other data when a support of corrected and othe

Better flax, together with better methods of retting, are bound to bring up the volume of the Irish lines

YORRHEA is the most talked shout dental discuss The

TORRIFAA is the most tailed When the control of the

received by the efficient tooth pick maint, that must is generally corporated. One can misselt a null driven into a board, or a post-driven into the ground, by striking either near the top or from side to pick. This missappled torce is what also mispens to the teeth when trumantic occlusion is continued for an indefinite time. The teeth are literally cherred out of their sockets.

The teeth may not erupt in a harmonious occlusion A slight irregularity might throw the entire occlusal plane out of a normal occlusion.

plane out of a normal occlusion. The most potent factor in the production of a periodorial complication in the occlusal wears of the teeth The occlusal surfaces of the teeth wear into odd and peculiar shapes during mastication. Sometimes grading the teeth during sleep has an untoward influsioned upon their surrounding tissues. When this wear continuous of the continuous during the continuous d for an indefinite time the teeth are worn into grooves and high points. When these irregular occlusal wears have taken pince, a greater mechanical leverage is then obtained outside the jaw and the teeth are easily forced from one side of their sockets to the other. This tooth movement breaks down the bone surrounding the tooth movement breaks down the bone surrounding the roots of the test breedving the uneven stress. The great force and shock incident to the rubbing or grinding the testh (together causes a traumatic injury to the mem-branes surrounding the roots of the teeth which results in their absorption, and finally in a loss of the teeth Frequently a case of province is observed in a partie who has no carifies and few or no fillings.

When Our Teeth are Out of Gear examination, however, discloses the fact that an absorption of bone has taken place to such an extent that

sorption of bothe has taken place to such an extent that treatment will be productive of an good or lasting re-sult. The patient in most cases does not recognise that such a had condition is present until the teeth are loose. It is almost too late then to begin treatment. This de-struction of bone surrounding the teeth is caused by a matic occlusion.

traumatic occlusion.

After the Xray examination has disclosed the true condition of the month, the operatur decides what teeth, is any, should be extracted. After extraction he proceeds stillfully to reshape all the remaining teeth. The high irrequire points on the occlusial surfaces of the teeth about be ground or pollahed off, the operature simultaneously wideoing the surrow constructed finances simultaneously wideoing the surrow constructed finances. simutaneously widening the narrow constricted fineures until there is a free easy goodyle movement during mastication. The teeth such most be reshaped until there is a harmonious contact of the teeth of the one jaw with the teeth of the opposing jaw, that is, they must much properly as in the case

of gears.

The reshaping of the teeth, together with the oblitera-tion of pus pockets, coupled with oral cleuniness, will generally subdue most prorrheal lesions, provided treat-ment has been instituted early enough

Investigation of Orifice Gas Meters

Investigation of Orifice Gas Meters
JOR several months the Bureau of Standards hat
I had under way the preliminary arrangements for an
investigation of the performance of orifice meters. Ortials special equipment, such as large sized air contractions of the performance of orifice meters. Ortials special equipment, such as large sized air contractions of the second originate o

may occur within the range of commercial or engineering practice.

In order to solve this problem it will be necessary to make a careful situdy of the effect of the following red belonger but districts the work of the following red belonger but districts the work of the following red belonger but districts the work of the following red belonger but districts the size and in a thin displaying to a long flow nonles; (3) the diameters of the pipe and existing flow nonless (3) the district are rest to fit of the order; (8) the lecentre, size, and finish of the pressure tapp; (4) the length of sizingle the pipe on each side of the order or the nature of the fitting or observed has seer the order, (6) the linear pracel through the order or the nature (6) the

rear
absolute pressure in the line and the magnitude of the differential. (?) the density,
viscosity, and specific heat ratio of the gas
and its deviation from Boyle's law; and (8) steadines

and its deviation. From Brofe's law; and (3) studied as and its deviation. From Brofe's law; and (3) studied as opposition to of the flow.

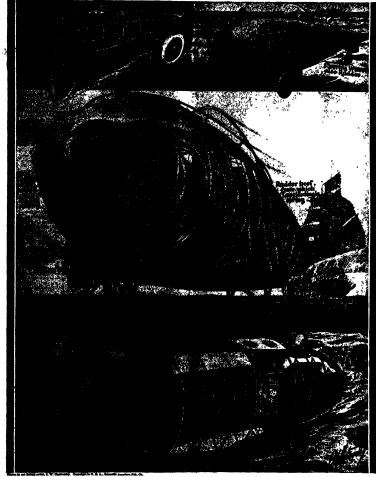
The setup as now arranged will permit the study with air of points Nos. 1 to 6, as enumerated above, through a wide range of conditions. It may be possible to the second studied of the second studied and the second studied as the second studied studied as the second studied studied as the second studied studied studied as the second studied studi

A Versatile Motorcraft

alterations and improvements.

Avermatile Motorcraft

DROBABLY the most interesting object seen by the delegation of American foundrymon during their visit to the Shipping, Engineering and Machinery Enthury the Company of the Shipping, Engineering and Machinery Enthuring the Shipping, Shipping,



QUIES STREAM-LINED CRAFT THAT MAY BE USED AS A HYDRO-PLANE, RACING AUTOMOBILE, AMPHIBIOUS BOAT, OR NON-SINEABLE LIFEBOAT.—(See facing page for description)

With the Men Who Fly—II

How the Glider Flights of German Students Have Brought About a New Era in Aeronauties

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Aviation History Repeats Itself— Gliding Flights

Gliding Flights
But while the United States,
Britain and France continued in
peacetine to develop their alriphane in the same direction, the Germana, forbidden by the International Allied
Commission of Control to build high-powered planes,
under an extensive study of the more subtle art of glidflag. This enforced specialization may be a treasured boon for aviation, as it may pave the way for low-powered planes and mark a new era in airplane con-

Often hampered by lack of funds, working to Often hampered by lack of rands, working under extreme difficulties, German builders had the advantage of cooperation by their universities, and rapidly devel-oped both wonderful machines and skilled glider pilots. German pilots achieved a truly remarkable control over German pilots achieved a truy remarkane control over their machines, actually describing figure "8" flights and other evolutions in motorless flight, and for a long time the German pilot Heutsen held the world's dura-tion record for gliding of 3 hours 0 minutes, until this tion record for gliding of 3 hours 0 minutes, until this was besetten by the Frenchman Manegyol at the Lewes most in England, October 21, 1922, where he remained makes the product of the state of the teresting achievements Forker, the famous Duten designer, has kept aloft for 13 minutes, carrying a passenger, and an English pilot, G. R. Olley, soared with a passenger for 40 minutes at the same Lewes meet. In the United States, Glean II. Curtiss, one of the early

a passenger for 40 indicates at the same Lawes most, in the United States, Glosm H Courties, one of the early piencers of the airpiane, built a ministure flying host with which is has achieved a number of short giftee, which will be a subsequent of the court of the



that the wings give the necessary sustention or lift. In achieving this forward velocity the rests-tance of the air acts on the wings and the rest of the gilder, and aband the rest of the guiser, and an-sorbs energy. This energy is sup-plied by gravity. In other words, the glider must lose sitting to sustain its gliding flight, and flight is not horizontal as in the case of a machine where resistance is overa muchlos where resistance is over-come by the power of the motor-acting through the propeller, but on a downwardly inclined path. In a good gilder the resistance of the wings and of the rest of the mum, the least possible energy is lost and the gilder is gentle one. In the first gilders such as those used by the Wrights the gilde path was one in five or six. In the best forman gilders when the path is one in diction, or to the e-con in gilder is 19 forc only one foot

In the October issue Mr. Alexander Edermi can a source of the control of the cont

altitude is lost. This shows

altitude is lost. This shows what tremendous progress has been achieved in diminishing the resistance of gitteen, and also of altimitiating the resistance of gitteen, and also of altimitiating the resistance of gitteen from one point of view. Furt this is aspeaking of Furt this is aspeaking of Furt this is aspeaking of foot and other thinds of the property of the

titude. The skill of the glider

The skill of the gittle plots in finding sterrein where there is an upward current of at to supply this energy When, the string of the string of the string of the string current which may sugain him or even the string current which may sugain him or even the string current which may sugain him or even the string current which may sugain him or even the string current which may sugain him or even the string current which may sugain him or even the string of the string current which may sugain him or even the string of the string

eaves indefinitely in this instiner. (Hidde is a similar from sailing, where great skill must be used to utilize dynamical winds.

But if the glider is no supriety, if dwartien flight, only and not flight from point to point has flum for been and the similar flum and the similar fl

What Aviation Learns Through Gliding Flights

What Aviation Learns Through Gilding Flights
But besides being a possible adjunct to the testing
of experimental ariptanea, the follow per so will beward
of experimental ariptanea, the follow per so will beward
efficiency of an airplanea in twentyl proportional to the
efficiency of an airplanea is inversely proportional to the
soliding angle or inclination of the glide path. In other
words, the more genite the glide path, of an airplanea, in a triplanea
(filling paths of commercial alirplanea as at present
designed are seldem better than one in eight. And the
result is that about 60 benespowe is required to charge
appeal of 100 miles per hour. These represents the concensurity, builders or gliders have improved the glide
path up to a value of one in streem, as in the German
concentry, builders or gliders have improved the glide
path up to a value of one in streem, as in the German
provement in the economy of alphane transportation.
Oliders must also be light, as otherwise they might have
velocity in still air; and also because a heavy glider is
more difficult to launch. Builders of gliders have
when the contract of the contract of

Advent of the Low-

It is really remarkable at can be schlered with use of small power.



iane. Carrying only one gallon of gas, Barbot flew om St. Inglevert, France, to Lympae, England, in 61 inutes, and returned in 44 minutes, winning a prise of 25,000 france for the trip. Flying the same plans in the United States, Barbot created a wonderful im presents of maneuvershilty and comount, but crashed in a stormy trip from Long leaded to Washington. Perhaps difficulty in useful query gardy air is the one big present and the state of the present and the on of meneuverability and economy, but crust

turous young man,
Apart from its value in technical progress, gliding is a fascinating sport. A certain amount of interest has been aroused in this latest sport in the United States, and amateurs are building and gliding all over

the country. the country.

It is also highly interesting to consider how far it is possible for amateurs to undertake glider construction and operation, and what value such work may have in furthering aviation, besides the fun of the game and

the possibility of winning prises at a meet

It is a well-known fact that radical discoveries and It is a well-known fact that radical discoveries and achievements have very often come from men not at all despty versed in science or engineering. The sir-plane owes its birth to the Wright brothers, who were not primarily engineers, although they developed the allowed the sirple of the science of the science of the possible that equally gifted, though now unknown amteurs may selse on the opportunities afforded by glider experimentation, and help in the scientific development craft by bringing fresh and ingenious minds to

of survant by modername bear on its problems.

Before undertaking this stimulating and useful form of activity a number of considerations have to be taken into account. A suitable terrain is essential. The

into account. A suitable terrain is es National Aeronautic Association in seek-ing the ideal terrain, apparently found Oakland, stated its require be a long ridge rather than a hill, with a total drop of at least 1000 feet, a slope of one in four at the top of the ridge and one in eight further down, freedom from trees and obstructions, and steady wind velocities of 15 to 20 miles steady wind velocities of 15 to 20 miles an hour. These requirements do not in-clude the fact that there must be some measure of upward current. A glider will not stay up indefinitely in any horizontal wind however violent, unless there is an ward current, at least an intermittent

soward current, as we have shown earlier in the article.

Piloting the Glider

While glider plicting is reasonably safe, the amateur must not underrate its difficulties. Gliding is in some respects more difficult than piloting a powered simplane. It is more delicate, more instinctive, less assorptible to raises and systematic instruction. If it ngitler pilot wishes to make duration glides, he must take advan-tage of every favorable gust, and use serodynamic principies subconsciously. He must appreciate meteoro cal conditions and adapt

himself instantaneously to every variation. Patience and long experience are necessary to achieve skill. It is possible that instru-ments may yet be devised which will help the glider plict in taking advantage of air conditions of every kind, But even without in kind, But even without in struments, it can be enfely said that in spite of these difficulties, piloting the glider is within the reach of sky young man, physically bound, with less per

sife borne.

and to function and a grounder of balance. There is believed as these products as these products as these products as the product of the products as the product of the produ

needed. Nor is very elaborate shop equipment nee by the amateur. The glider can be built in one's be yard with a few simple tools. Any slightly diffic Any slightly difficult wood or metal work can be readily farmed out to some small local machine or wood shop.

It is in the planning or designing of a gilder that an mateur constructor must exercise the greatest care, be wishes to build an original craft. While amateurs may ultimately develop useful and novel forms, mere "freak" machines are doomed to be a disappointment The best gilders are those which utilize in the best pos-sible fashion certain very simple laws of aerodynamics "Bats" and "flying fish"

and other monstrosities but the shortest sildes and w little or no stability

Certain basic require ments must be fulfilled. These include light con-struction, so that a light loading in proportion to the wing area may be secured a high aerodynamic effi-ciency, stability in flight, ample control under all

conditions, and ample strength, combined with

strength, combined with a light construction as is consonant with strength. Light leading in proportion to the wing area is im-portant because this means case in get-away, and slow and casy landing. For high nerodynumic efficiency, a and easy landing. For high aerodynamic emiciency, as clean, graceful appearance is necessary because this neems a small gliding angle, less loss of alltitude when there is no favorable current, and maximum gain of altitude when there is a favorable current Rability and correct bissance in the glidler are as important as in the powered airplane, and are achieved by much be-same methods. A study of the disposition of the center



Typical low-power airplane in flight. This is the R III sport monoplane developed in Germany

varying positions. The balance is of the general type of chemical balance used for weighing relatively large quantities, but ditted with every latest appliance to avoid error. No human hand comes any where near the balance when numan nand comes anywhere near the onlance when it is in the The crystal to be weighed is first placed in the required position in a sort of frame connected with a series of rods proceeding from the balance case and extending through a brick wall about six feet away It is then weighed to what would be called extreme accuracy by the experimenter standing in the balance room and putting in the heavier weights by hand

in much the same manner as the usual airplane, cording to the inventor, the measured power required for flight is less than that which can be developed

for flight is less than that which can be developed with the propeller operated with the foot pedals. Aviation progress of late has been exceptionally rapid and quite spectacular, so much so that it has found considerable space in the daily press and in dulty conver-sation. The thrilling flights of Lieut Ruosell Maughan,

the inauguration of coast to-coast serial mail, the comletion and trial flights of the giant beliam-filled. Amer pletion and trial flights of the giant neutonment, associan-built dirigible "Z-R1," the smashing of records for speed, endurance and altitude—these are but a few of

the numerous steps for-ward, which will be dealt

with in a comprehensive

A Delicate Balance

DR. PAUL R. HEYL, of the Bureau of Stand-ards, has constructed a bal-

ance so delicate that it will weigh three pounds with an error of not more than

one part in a billion The method involves the weigh-

ing of large crystals in

manner in an early to

The whole balance is then encused in movable walls of cork composition about two inches thick, leaving just room enough for the control rods and for the reflection of a beam of light on a mirror, the swings of which measure the final balancing. The experimenter then leaves the room which is closed tightly with a double door and left to come to a uniform temperature.
This takes nearly an hour, after which
the room does not vary one-tenth of a degree from one part to another. It is most important that the two arms of the balance shall not vary in temperature by more than one-thousandth of a degree, as

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this would introduce into the experiment an error of one part in several million which would ruin its value. The weighing is then made by the operator sitting out-side the brick wall and controlling the final delicate weights with the rods projecting through it.

Carles Care Typical gilder flown in one of the French gilding meets. Note the trim

of gravity relative to the wings and the setting of the tail relative to the wings are well worth while. Ample control surface areas are sensital because the gitter is so susceptible to air gusts, and at the same time the effectiveness of the control is less than in specify, high powered airplanes. In considering strength, it is true that a gitter never has to meet the violent loads which may come on the powered airplane, but it is much lighter so that adequate strength is almost as hard to secure as in the airpiane proper Binaily, there must ber cutapult, or if hauling

by a rope is used the rope must be automatically re leased when the machine leaves the ground. An American Cycleplane Attempt

Aerodynamic features embodied in the cycleplane that will have a material bearing on the future con-struction of smaller air-craft are said to have been proved with the first suc-cessful flight of an Ameri-can-made machine, The "Scientific Curios-

The "Scientific Curiosread plates The "The "Scientific Curiostigs" to term to the Air
Recrice, is proposed by an end of the Air
Recrice, is proposed by an et of pedals shinker to these
used on a letycle. By a chain remander, when
pedalled, the proposites receives, and in moving forward
are cycleptas as altent from the promotion and
capable of length flight in the air is promised by the
inventor as the entgrowth of accessful experiments
with the original model.

wings give the cycleplane its lift, it has no lift, its upward flight is governed by the elevator

Villa's Buried Treasure

A T first blush it would seem that we have no interest
A in Villa's bars of gold or bags of silver which he
buried at night on his ranch, and indeed we have not,
but some of our readers probably will have and we shall be usked to recommend the best divining rod and

shall be assed to recombined the best divining rea and the shortest route to Mexico.

The story of buried money never palls and is never diminished in the telling Indeed, legends of buried treasure are better than compound interest, for they are compounded every time they are told. From time to time expeditions are fitted out to visit the Cocon Islands or some other lair of pirate crews of the long Islands or some other lair of partic evens of the long ago Robert Louis Stevenson knew this weakness of the human race who desire housely to find a treasure-trove usually left by an essentially dishemest or criminal crew, and capitalized it in that rattling good story,

But all this is getting away from the divining rod But all this is getting away from the divining roa As far as all our investigations have gone, the searches by lay persons for hidden gold and silver with artificial devices have all been abortive, and we think that the Government is very much of the same opinion, for the Government is very much of the same opinion, for the pumpliet on divining rods, which is among their "best sellers" is eagerly sought for We do not say that an expert geologist may not be halped by electrical devices. All those who have them are so very charry of ever left. The sellers which have them are so very charry of ever left. The sellers would ever get out of the country alive with the pot of gold at the end of the rathbow, even if he found it. That fragitive from justice, Goiver Clerchial Bergolis, it believed to have burded a large sum in gold cells numerical to it is the sellers which the country alive of the sellers which the country alive many control of the sellers which the sellers which the sellers would be burded as the sellers which is the sellers which the sellers which have been dealers and discontinuation of the second control and discon



by Compressed Air Saving a Cathedral Compressed Air Drill and Grouting Restoring Lincoln Cathedral by the

IIS is the story of the rescue from collapse of one of the greatest cathedrals of Great of one of the greatest cathedrais of creat Britain, by means of the compressed-air drill and cement grout forced into its dissured walls under air pressure Much as we may admire the architectural beau ties and wonder at the size and majestic dignity of the medieval cathedrals, it has to be admitted that in the memera consecrats, it has to be admitted that in many of them the work of these early masons was of very rough and inferior character. This is particularly true of the early Norman work of the twelfth and thirteenth centuries. The construction during the four teenth, afteenth and sixteenth centuries was generally of a better countir.

of a better quality

The trouble with the Norman work was that the
massive piers, ten feet to twelve feet in diameter, and the walls from six to eight feet in thickness, consisted of an interior of rough rubble work set in mortar, with an outer casing of dressed stone with squared and fairly well-fitted joints. In the course of the centuries fairly well-fitted joints. In the course or the centuries the mortar, which was often of an inferior quality, deteriorated and lost its binding and holding quality, and from the thirteenth century down to the present time much of the early work has given unending trouble time much of the early work has given unenning fromme Maturally, the principal difficults has been experienced with the towers, and particularly those at the crossing of the nave and transcept. Here the super-incumbent tower load, of from 3000 to 5000 tons weight, proved too much for the four piers upon which it reste the result that in many of the cathedrals, both in England and France, the piers have crushed or buckled, and the whole tower has come crashing down upon the church below This happened at Winchester, Chichester, and to the first central tower at Lincoln, not to mention several others which suffered the same fate

Several insecure towers have been saved from col-lapse, during the reconstruction work of the last one lapse, during the reconstruction work or too less one hundred years, only by emergency repairs in which the tower above was held up by a perfect forest of massive filmer shoring, while lighted centest groat was poured into the interior rubble work to hind the muse once more, as far as possible, into a solid and unyielding

mapper.

The present article deals with the northwest tower of Lincoln Cathedral which, in our illustration, is the one to the right showing above the main roof The lower part of the two western towers, to about the level of the ridge of the roof, is of Norman construction as will be evident from a study of the round arched will be evident from a study of the round arease windows and the plain square buttressing at the cor-ners. The upper part of the towers was udded in the later reconstruction and enlargement of the cathedral. This Norman work is characterized by the rudeness of This Norman work is characterized by the rudeness or construction referred to above. The present damperous condition of the northwest tower, as shown in our photographs, is due partly to the nature of the construc-tion, and also to the fact that the cathedral was badly wrecked by a violent earthquake, which took place in the year 1185, and necessitated the rebuilding of the Norman Cathedral



Westerly towers of Lincoln Cathedral. The right-hand tower, it will be seen, leans to the right

The cracks which were opened by the earthquake in the northwest tower, in spite of the continual repair work done at various times during the past seven cen-turies, have steadily widened, and the tower has settled in a northerly direction until the deviation is visible to the eye, as will be noticed from our photograph showing the westerly towers. The condition of the towers, and the westerly towers. The condition of the towers, and indeed of many other parts of the cathedral, was so serious that a vigorous campaign to secure the \$250,000 needed to save the cathedral was started a few years age, and the present work of thoroughgoing repair was rtaken in 1922.

The walls of the tower are smormously massive, reaching in one place a thickness of venty five, neverthering in one place a thickness of venty five, neverthere is the control of the cont The walls of the tower are enormously ma ans never rendered possible by the use or a very encueva-American tool, the compressed-air drill. With this most useful tool holes are drilled many feet into the heart of the wall, and liquid grout is forced into the mass of massury, where it follows along every crevice to the

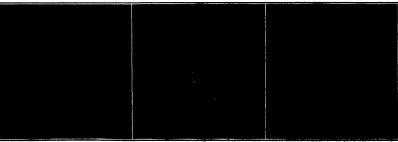
utmost extent of the fracture, filling all the voids and binding the ribble work into one solid and immersible hand, the use of compressed-til cridin and of spillenstic pressure for forcing the grout has cut down the cea-ture of these repairs semmeanty Indeed, it may be said without exaggeration that the compressed-til criti has by thousands of Americans, from desuredists. A con-siderable part of the funds for the work has been con-tributed in Americans, from desuredists. A con-siderable part of the funds for the work has been con-tributed in American from desuredists. A con-siderable part of the funds for the work has been contributed in America; and the Dean and Chaptee have decided to parks the repairs to the large control lower cuttingly with such funds as are subsected in the Dalied at the crossing, which is not visious in our poorograps, entirely with such funds as are subscribed in the United States, and to constitute this work a memorial to Amer-ican cooperation. Of the total sum of \$50,000 required for this tower about one-half has been subscribed.

A Photographic Museum

IN Prague there is a wonderful museum devoted to buttons and other fractenings for clothing. It was founded by a button manufacturer who thought that, as his fortune had been decived from these humble objects, it would be a graceful thing to found and endow objects, it would be a graceful thing to found and endow a special nuceum of this nature. The other day we were reading a letter in a daily paper which gave an excellent idea for a nuceum, and we think it is worth while to pass it on to our readers. The letter suggested that Mr George Kastman found a museum of photo-raphy The idea is fundamentally sound, as it would raphy The idea is fundamentary mount, acbe most appropriate for one who has done so much for photography to go a step further and collect all the photography to go a step further and collect all the course, Mr. Exatemats profits are legitimate and are his own, but he has shown suck great spaceoutly in found-ing cultural schools of music and the silent drama, to him that he is shown suck great spaceduly in four where so much work in pure sedence is carried on. In this work of the sedence is carried on. Misseum of Washington and in the Schene Museum of Misseum of Washington and in the Schene Museum is in seeded is a real museum containing all possible ex-hibits which will included in this beautiful art.

Tests of New Design of Large Hawsers

Tests of New Design of Large Hawsers TWNSILE sets have recently been made at the Bi-Treau of Standards on 21 samples of very large hawers. The purpose of these tests was to determine the comparative streamly of a zero type constructed the comparative streamly of a zero type constructed of construction. In the new type the inner yarns of the strands are untwisted. The strands are made up of several outer layers of twisted yarns binding this inner compact mass of Shews. these strands being twisted in the usual manner to form the type. The tests aboved that it all cases the new type of construc-tion increases the strength of the type.



This wide crack is typical of the disruption that was taking place in the old Norman Tower falling apart. Note the temperary props

Automobiles and Near-Automobiles

Astensehles and Near-Automobiles

Olf of the incident that is poremainly green is that
offer the shall attend the which which may be clasalled as an activation of an activation of the shall attend the which may be clasdied as an activation of the shall attend to the continue of his dispution. There seems to be no end to the number of wars in which the automobile and the power bits
may thus he hybridized One of the latest and we think
right supplies of the panes. Our communicate cannot be ber of ways to which the automobile and the power bits may thus be sylvicitized. Once of the latest and we think may the second of the latest and we think may the second of the latest and we then the second of the latest and the latest clearly clear to the latest clearly clear to the latest clearly clear to the latest clearly clear the second of the latest clear that is to say, the passenger, it can be considered that the second of the latest clear that is to say, the passenger, it can be considered that the second of the latest that the second of the latest the second of the latest that the second of the latest the second of the latest lat

The one at the lower left is another London type This vehicle makes the defuite claim to classification as a car, definite ciaim to classification as a car, the owner and designer referring to it as a runabout It carries a 2½ horsepower engine, and its constructor proudly as-serts that it is faster than any motor cycle of similar power. It will be noted that he has bolstared his claim to the proprietorship of a real car by installing running boards and a hand brake and that again the driver rides in the com parative luxury of a regular seat Indeed he has less the effect of riding astride than his compatriot diagonally opposite him on the page and is sufficiently near the road to get all the thrills of racing out of a

to get all the thrills of racing out or a A light
The photograph in the center of the
The photograph in the center of the
The photograph in the center of the
Salty Sength a regular attention in the salty sength a spiller attended it. I represents as
solitor to shorten the wheel hase for tight driving in the
compassed city. The tary four-cylinder motor is installed
at the sear of the car leasted of the front An effort
is naple to behave weight by placing the engine proper



halfit chang to the ground describes this example of the London systems

at one side and the fivwheel at the other and the position of the latter indicates that full advantage has been taken of the motor a unique boation to avoid the necessity of transmitting the power around a course to the rear axis. The horsespower is given as eight The car was exhibited at the recent Franch automobile show, where it elicited nungl Auvorable comments.

Forests and Fertility

Forcets and Fertility
It is can be unfortunate results of civilization
I that while in ground they can only some
anothers on the ground they can only do so by usual
histing other forms of life. In this way man has
trublestly destroyed treas to make his house and to
make vary for his focks, without candidring, what
resources of the region he lives in . Also point never
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A light French car with engine at the rear, and shafts parallel to the axles

Preach car with engine at the rear, and shafts parallel to to shooth water through its roots from the ground as that if it cannot penerate deep south, to get smill feet and the control of the control o

Figs.

In the fourteenth and fiftsenth centuries the Apennines became deforested some say became it was befored that the devastating plagues of the Middle Agenwere caused by trees, or it may have been to got more



One of Britain's latest efforts to combine in a single ugn the advantages of car and eve

passure for the trowth of the wool which made Florence so rich and fams us at any rate the result was distributed. A headance pasture of first up the rivers rapidly rose in flood and curried more and more graved down to the sea. The harbor of Pha became closed and obliterated the Pleans ignorantly blanning the Carboos for the harby done it in one of their

raids Now there are miles of unhalthy marshes between Pisa and the sa and marries between Plsa and the sia and there is ne harbor for even a row boat to shelter in and this is all traceable to the ground getting hard and taked in the absence of trees—Abstract from articles by Col H de H sn Discovery (British) tor May 1928

A New Anesthetic from Sleeping Flowers

A S far back as 1908 forists complained that carnations when placed in green houses would go to sleep and those which had not opened would fall to do so caus-in, great loss in their business. Investi ing grat loss in their business. Investing the proved leaky gas fixtures to be the cause. Class contains four per cent of ethylene and it was shown that one part of this gas in 2 000 000 parts of air caused. already open fit wirs to close Other in westigations showed a similar effect of the gas on ther junts This led Dr Iuck hardt and Mr Carter of the University of Chicago recently to test the gas as an ancestheti. The gas was tried first on

can whether I The Lass was firld flow an anunt ru minute such as frags mice such as frags mice such as frags mice and in the such as frags mice and in the such as frags mice and if such as frags mice and if such as frags mice and in the such as frags mice and in the such as frags. I will such as frags mice such as frags mice and in the minute of a dispersion for the such as frags mice and mice minute such as frags mice and mice minute such as frags mice and cent ethylene and 10 par cent oxygen. The experimenters then tried it on themselves. They describe the effect of the gas mixed with oxygen as exhibarating and giving a sense of well being. They became unconscious and then subsequently recovered without realization that they had been unconscious, beyonal students then volunteered. had been unconscious been rai students then volunteered. Complete surgical anesthesia with muscular relaxation was produced in a few minutes. Subjects had plus thrust through their arms w.r.e. plus hed severely enough to leave black and blue areas and one was beaten on the soles of his feet with a "tillson wrench beaten on the soles of his fret with a unimon wearch without any sensation whatever or memory of discome fort. Recovery was complete in a few minutes. The only after-effect was slight weakness and slight names. In every case the subject are a full meal within a few hours after recovery. It is claimed that the new ance-thetic gives loss of sensation long before complete, surgical anesthesia is established that it may be main with complete muscular relaxation, yet without any sign of suphyxia shortness of breath or effect upon the blood pressure and that there is rapid recovery even after long administration without evidence of after

nt as this discovery is to all of us there is nothing definite as yet to indicate its importance to the medical world. However one thing is obvious and that is the relatively insignificant cost of this new anesthetic arthermore it is almost universally available al-ough its use must be kept in competent hands to avoid by possible danger from over-dosage



Ball Bearings and How They Are Made

The Tiny but Perfect Spheres that Keep Down the Friction Toll in Modern Machinery

By Robert G Skerrett

HERK was a time, and that not long ago, when a lubricating film of some sort was the only means of offsetting the clinging or hampering contact between contiguous sliding or revolving surfaces, and, even so, there still remained the demand for more or less unproductive power to overcome the inertia of or less unproductive power to overcome the inertia of the "doud load" and to keep the mass in motion. Thanks to "." weel-opment of ball and of roller bearings the effect of these physical conditions has been very greatly altered for the better, a lesser effort can achieve more than was readable before the adoption of these beauti-

the state of the s

tell here the story of the manufacture of its older brother, the ball bearing

The use of these bearings has become so general and they can be purchased so readily that the average per readily that the average per-son looks upon them as a comparative commonplace and gives little thought to how they are made. To him a sixteenth of an Inch is a relatively diminutive meas resatively diminutive mens urement, and yet the steel balls for bearings are fash loned to a dimensional pre-cision of a ten-thousandth of an inch. This is essential, for if the assembled spheres in any bearing were not of mellater perfect midwarks. well-nigh perfect uniformity in size the load upon them in size the load upon them would not be evenly distrib-uted, and the bigger mem-ber of the group would have laid upon it the whole bur-den and would probably be shattered in consequence. ning and adherence to precision are essential in turning out upon a commercial scale the rings or races which hold the balls.

hold the balls.

Now let us foliow through the various stages of the making of hall bearings—starting with the prinary raw material. Chrome steel is required for these parts, and while its composition may vary to a degree, it contains agenerally 1.28 degrees chromium, 100 curbon and 0.5 manganese The metal, when oll-hardoned and temperal, has a fine silly grain. Notes of this steel is issued for working up matil it has been subjected to both chemical and drystell tests in the plant historiary. notification and paysed tests in the plant innoratory, and it is customary to cut from a sample bar a piece one and a half diameters long, and crush it cold to two-thirds of its original length. The metal is not acceptable if it shows any sign of flaw or splitting after this

trial. High-grade balls up to three-eighths inch in diameter are frequently machined directly from rod steel, and for this purpose a form entries the employed which turns of the purpose of the purpose and the steel of the purpose of the steel of the purpose of the steel of the spheres are made ready for rough grinding which trans-

forms them into perfect spheres, slightly over size. The third stage is the heart teratment, and this is sallike both for the balls produced by the form cutter and those which are manufactured by the form cutter and those which are manufactured by the dust process of the dust process couplings with suitable dise, and a suitable destinated to the description of the dust of the dust cient length of rod or wire is used in each case to make a string of from eight to ten spheres at a time. The forms them into perfect spheres, slightly over size The

hot by presses equipped with suitable dies, and a sufficient length of rof or wire is areed in each case to make a string of from eight to ten spheres at a time. The bound to one suncher by a tilin strip of street called a "fash." This is afterward sheared and the separated balls are given a rough griddless. In some establishments the present of the sunch street should sunch street the sunch street should sunch street should sunch street should sunch street should sunch such street should sunch such street should sunch sunch sunch sunch such sunch sunch

for instance, every minutes.

No small part of the acceptability of the utilimately finished ball depends upon the manner in which it is first hardened and then annealed to retieve it of in-



Assembly and inspection department of a well equipped ball-bearing factory

from the furnaces and dropped into a bath of oil or water—the oblice of fluid depending upon the sine of the balls. The depth of the tank is requisited so that the balls better, when the property of the tank is requisited so that the balls better, whence they are more local time better, whence they are more local to the better, whence they are more local to the temperatures at the possible to hold the temperatures at the points which experience has proved best satised to such also of ball and to the particular the property of the provider of the property of the provider of the provid

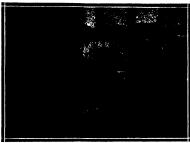
Ucular class of speci used for them
After hardening, the balls are tempered
by being bolled, according to their size, in
oil or water for several hours. While this
temperature is relatively low it induces
plysical changes in the steet, "seasons" it,
and, without affecting the surface hardless, brings about internal readjustments ness, orings about internal readjustments of the metal and puts it in a state to withstand a considerably greater crushing stress. When the balls have been ammealed, they are then freed of any attached scale in tumbling barrels within which they are agitated in the presence of a mixture of potash and grit, and this is succeeded by a agitated in the presence of a mixture of potash and grit, and this is succeeded by a second barreling operation which, by re-course to potash and a fine abrasive, finishes the surfaces of the balls to a point

where they are ready to undergo the hardness test. where they are ready to undergo the naruness test. The manner of making this varies. At some factories ten bells from every batch are crushed successively to destruction in a hydraulic press, and the pressure required to do this in such case is indicated by a gage d this test, the balls are now given the

Having passed this to final finish and polish

The finish grinding may be done either by machines substantially like the rough grinding machines, save that finer grinding wheels are used and the work is done in oil, or apparatus may be employed of the knurling type, already referred to The grinding wheel is forced against the bulls at a pressure of from 400 to 600 pounds. The final polish is imparted by two or three "lapping" operations. For this purpose "stanes" of fine grade are substituted for the harder cutting wheels and then a leather wheel, with a mixture of crocus and oil, completes this phase of the process. At some plants the balls leave the first lapping machine from three to ten thousandths of an inch over size. From the second machine they issue one ten thousandth of an inch over size, and from the last machine they e substantially exact as to size and of a high finish Gilttering as they are, however, there is yet more to be done to them before they acquire the perfect polish demanded in the commercial article

Following the lapping, the balls are tumbled in a barrel containing rouge and a quantity of bits of leather, and when this has continued for many hours the balls are given their final shine in another tumbling the balls are given their final shine in another tumbling berrel, charged with a solution of potash, in which they remain for a period of from eight to sixteen bours. Care the property of the control of the control of the control to the control of the color of the balls by importing to them a brownish tings. The last step involves rolling the balls about in a third barrel carrying a mixture of leather and sawdast, and this dries and leaves them altery spheres of vonderful smoothness.



Heat-treating furnaces and quenching tanks in which ball bearings are hardened

While the lapping and tumbling operations are in prog-ress, the balls are from time to time very carefully aged. The concluding againg, however, does not take place until about 12 hours after the balls are removed from the drying burre! This allows ample time for them to cool down In the meantime they are visually inspected for cracks, flaws, or soft spots. Girls are employed for this work, and they show remarkable

employed for this work, and they show remarkable skill in deterfling quickly defects which would scarcely skill in deterfling quickly defects which would scarcely The impection is done in a weblight of department. The impection is done in a weblight of department and each girk, seated at a table, has a shallow tray in which is laid a bottom of gluss or a sheet of white paper, the reflected light in either case a swing to illumina the underside of the ball so that no imperfac-tion can idde in the similars. Then or a daster halls are too can be considered to the similar are thus examined simultaneously. By tipping the tray slightly the balls are induced to roll away from the keen-eyed operative, and the least lack of sphericity in a ball will cause it to deviate laterally from the straight a ball will cause it to deviate laterally from the straight path Defective balls are picked up by magnets or pincers and cast aside, while the remaining ones are dropped into a box for gaging In some plants the inspectors wear soft chamols gloves, for the least touch of the bare fingers may produce a rust spot. In the course of an eight-hour day a girl expert can examine quite 5,000 half-inch balls, for example

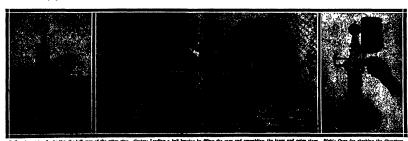
From the inspection department the balls are sent to a gaging room, where the atmosphere is maintained uniformly at a prescribed temperature, and there the bulls ough machines which automatically classify are run through machines which automatically classify them into sizes varying by steps of five ten thousandths of an inch. The process constats fundamentally in letting the balls roll down between a pair of allghity spreading metal guides and as they travel along the tapering alot so formed the balls drop successively through openings, corresponding to their diameters, into this or boxes beneath Over-stated balls are deposited in the lowest and last receptacle. The final lonal test is made by girls who do the gaging by pushing the balls through rings or perforated plates, which are accurate within the limits of possible measure-ment. The operatives judge by the sense of touch, i. c., the case or reluctance with which the balls can be put through the prescribed ring or plate, whether the

heres are acceptable or not. While the guaranteed accuracy of the while the guaranteed accuracy of the balls is within the margin just cited, there are factories which produce these steel spheres considerably closer to the stipu-lated diametric dimension. For instance, the balls are graded into eight sizes inter-mediate between the limiting sizes, and the difference, therefore, between two successive groups is only one fifty thou-sandth of an inch. All the balls for any one bearing are taken from but one of hese groups, and in this way the sphin a given bearing are as nearly identical
as it is humanly and mechanically feasible to make them No less care is exercised in the man

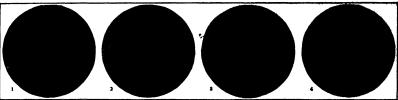
facture of the races and cages which hold the steel balls of a ball bearing. The inner and outer rings for the larger bearing machined directly from oil hardened drawn-steel tub ing, while the rings for the smaller sizes are cut from solid bars of case-hardened steel—the inner ring being from the core removed in machining the outer Whether tubing or bars be employed, the matering rial is chrome steel

When the rings have been cut and machined to within eight or twelve thousandths of an inch of their ultimute displetors the bore is beveled at each end. id a groove is turned in the ring for the ball-tr With this work done notches are cut between a side and the ball race so that the balls can later on be inand the ball race so that the balls can later on be in-serted Practice in this reserve varies in different plants. The rings are now ready to be bested in gon-tion and ball. They are not receive the period of the into an oil ball. They are not rempered hybolling for a considerable while in water. The tempered rings are tested for luminess and play field integrity by being dropped edgewise on to a steel anvil. This is called the bounce test, the height of drop and the corresponding height of rebound being different for each size of ring The examiner determines by the bell like sound of the dropping ring whether it is perfect or faulty both structually and as regards hardness

Having passed this test, the rings are ready to be ground to their final sizes, and this is done with remarkable accuracy Now comes the still more impor-tant step of grinding the ball-track or race, the path of which is of a radius only about 3 per cent greater than that of the balls which run in it. In order that the that of the holls which run in it. In order that the artisan can do his part to a nicety, his grinding machine is frequently equipped with a gage which visibly indicates just how the process is progressing. When a ring is thus finished it is subjected to a final inspection which is quite thorough. Here, again, expert training plays its part, and the qualified inspector, merely by employing a scraper, fashloned out of a (Continued on page 375)



Legis Appendum for tenting the held rause of the octor ring. Conters Londing a hell burning by Mings the says and assembling the inner and outer rings. Bight: Gags for cheeking the



Keeping Our Water Fit to Drink

Microscopic Denizens of Our Reservoirs, and the Means Used to Keep Them Under Control

By Dr Frank E Hale Chief Chemist Bureau of Water Supply New York City

IF water supply of New York City is im IF water supply of New York City is im-pounded in approximately fifty reser-voirs. Many of these are of extremely large capacity. Ashokan reservoir alone entains 130 billion gallens. Renaice, 30 cutation 1 to Million gallens. Avenier. 30 cm of the million gallons from 1 at 26 th billion gallons from 1 at 26 th billion gallons from 1 at 26 th billion gallons from 1 to 16 billion, asilons such the entire Croton waterwhed with 1st twelve reservoirs and at lates has a combined storage of 100 billion gallons for the control of the control of 100 billion gallons are combined to the control of 100 billion gallons are combined to the control of 100 billion gallons are combined to the control of 100 billion gallons (apacty). The mere handling of such minute squantities of water provides a seri tag priblion. The Department of Water Supply has three laborations and the control of 100 billion gallons are made at all three Jivery one of the above, reservoirs requires extended to the control of 100 billion gallons and 100 billion gallons are control to the control of 100 billion gallons are made at all three Jivery one of the above, reservoirs requires extended to 100 billion gallons and 100 billion gallons are made at all three Jivery one of the above, reservoir requires extended to 100 billion gallons and 100 billion gallons are made at all three Jivery one of the above, reservoir with the cond to the control of 100 billion gallons are made at all three Jivery one of the above reservoir with the cond to the control of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at all three Jivery of 100 billion gallons are made at a

animation on a regular schedule not only at one point, but usually at several. Re a volers with top and bettom draft are sampled at top and bettom and the largest and the most limp retail are sampled at several points. Last year 4177 microscopic examinations were made. I run the standprint of pulatability and of the estibetic character of sater supply there is no more Important examination than the microscopical analysis.
This examination discloses and measures the minute animal and plant life that is present in all surface animal and plant life that is present in all surface waters and in some wall water. Large amounts cause waters and in some wall water. Large amounts cause the frequently cause complaint because of a seem pro-duced when both tube are filled with hot water or or a stain left upon the sides of the white poreciain. The lattice of the water of the side of the con-traction of the contraction of the con-traction of the con-traction of the contraction of the con-traction of the contra

metricretice with the manufacture of co-rect colors by dye manufacturers and with the dyeing of goods by the dyers. Photog raphs may also be indicated. The pres-ence of certain types of mitroscopic or ganisms frequently serves to identify the source of a water. The contamination of a well supply by surface water may be indicated by the presence of microscopic

Its fur the most important reason for determining microscopic organisms is their connection with disagreeable tastes and connected with disagreeant traces and odors in water supply. Hose so-called littoral growths which are attached to the banks or lattoms of reservoirs and which attract the quickest attention are not concerned as a rule. The trouble is manufacture essential oils or perfumes like manufacture essential bits of pertunes the those of flowers Exceedingly minute amounts produce pleasant aromatic gera nium or grassy od rs which become fishy oily pungent or vile in larger amounts or upon decay of the plant growths Particular species may frequently be identified by the odor by those who are trained in this work. Three groups of odors are distinguished aromatic (germium) caused by distonaceae grassy caused by cyamphaceae and fishy caused by chlorophyceae distinuaceae and protoson Three are in all 22 species which

tonacease and processos 'tneve are in all 22 species which have been known to cause trouble

In New York City a supply despite the diversity of its sources the only species which have given offense from odors or taste have been Asterionella 'Labellaria Anabaena Aphanisomenon (with admixtures of Clathrocystis Microcywtis and Coslompharium), Uroglessa Synura Dinobryon and Peridinit

Symura Dinobryon and Perddintum
Anterionalis when present in 500 to 1000 standard
units per cubic centimeter produces a slightly aromati.
door At 1000 units rarely less the door is distinctly
similar to that of the geranism. The odor increases in
intensity with increasing numbers until several thou
sand produce a field, odor. The fiely odor is also produced when smaller quantities die.

duced when smaller quantities die
Tabellaria and similarly Asterionella in very small
amounts produces an earthy odor (also produced by
large amounts of Vyndra), passing through the arematic geranium and fishy stages with about the same
relative quantities of organisms av Asterionella At
times the olor of Tabellaria has suggested illuminating

times the color of Tabelista's has suggested illuminating as no other organisms long present present in 500 to 1000 units produce a fainty grass of ore like freshred grass. With larger numbers the ofor becomes pungent like neastertium. In large numbers or when decay Unoptain produces an old, safety taste and ofor first noticeable in probably 500 to 1,000 units. In larger numbers of the color first noticeable in probably 500 to 1,000 units. In larger quantities It is rey discreased be finew being long safety and the color first noticeable in probably 500 to 1,000 units. In larger quantities It is rey discreased be finew being the first being the first probably 500 to 1,000 units.

Rynars may cause trouble apparently in any amount, judging from the recent experience, at least as little and mounted the second of the second

no after taste or an apparently do not affect the allicroscopic or paisma apparently do not affect the allicroscopic or paisma apparently do not at times produce nauses or distance for food. It would take 12,000 units of advertiseable per cube centimeter to add a milligram of solid matter to a gians of water hence the practical Taste from the control of the contro

The first method of control is to shut of the troublemore reserved and allow it to stand if possible. In threeworks are allowed to stand if possible in threemore reserved and allow it to stand if possible in the
reserved and the standard is to shift draft from
non portion of a reserved to another if possible, as for
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Chlorination plant at the Renator reserveir of the New York water-supply

Edget Wind Tuenel ? Works Like a Giant

TOY the petitionist and adaptation of application and adaptation of application models in a special wind transfer devoted expressity for that purpose, the National Advisory Commit pose, the National Arrivery Commit-tee for Assignation—one of the out-standing organisations of its charac-tee is undestood—is performing and very tienarholds work at its Langley Flaid, Vinghan, inhoratories where a midget experimental chamber of un done is now in

The theory of the usefulness of this particular type of turnel the first of its kind harnessed for research investigations in this country is based upon the fact that at con

is based upon the fact that at cen stant temperature, the density of the Compressed-size attractions. This simply measurement that it necesses in proportion to the absolute pressure. This simply measurement that it needs of a wind tunnel one-to-ensurement that it needs to a wind tunnel one-to-ensurement that the provides conditions at the same proof of the control of the control

signed by D L Bacon
The tumnel proper is five feet in
diameter at the experimental cham
her and is sactioned in a cylindrical
tank with hemispherical ends. The
walls are hollow, providing an annu
lar dead air space in which the
halance mechanism is installed. The halance mechanism is installed. The steel talk is strong enough to with stand an internal pressure of 20 at mospheres while it is large enough to provide a return path for the air stream between the walls of the tun stream between the walls of the tun nel and the tank A balance of novel construction is arranged for electri cal control either by hand-operated switch or automatically from outside the tank. These manipulations of the switch attach or release heavy bal ancing weights by means of special

states where the present of re-cities are the second of th

Is at one and while the drive shart for turning the propeler passes through the shall at the opposite sed. The turnel proper is made of wood, quincide at the proper day of the control of the con-trol of the control of the con-pressed and settl actions supported within the tank by a structural steal frame. Trumpet shaped defactors made of sheet metal are fitted into the tank at either end to assist in maintaining a smooth flow of air frame the lance to the outer channel

of air rices the maner to the outside the cand vice verse.

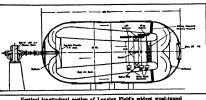
Chreatation of the air is effected by a two-binde propeller saven feet in diameter located in the outer and of the drift consideration as and driven at a speed of 900 revolutions a sinknets. A 250-horsepower motor mounted to the candidates. and derivate is speed of 900 revolutions as thinken. A 250 hoverprover motor on thinken, a 250 hoverprover motor on on a supersto bine at the end of the text drives the personal the device in facigate equalities and the end of the text of the end of the text of the person therein the head of the text hip a foosity packed plants through which of it often the end of the text of the end of the text of the end of the text of the text of the end of the text of the text of the end of the text of the text of the end of the text of the text of the end of the text of the text of the end of the text of the text of the end of the text of the end of the end of the end of the end of the text of the end of the end of the end of the text of the end of the end of the end of the text of the end of



Compressed-air wind-tunnel at Langley Field, showing observation platform and air

When operating at its greatest density the new nication can be defined from the Suprintendent of Langley Field air tunnel is equivalent in scale to a locument Government Printing Office Washington, tunnel 100 feet in dism feer running at 60 miles an hour De tank can be infinited to 20 aim spierwel in one and

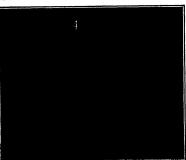
The tank can be infinited to 20 atto sporers in one and one half hours by means of the two or mpressors. A primary compressor driven by a 200 is responser mitor is used to provide pressure or additional that range fr m one to eight atmospheres. If k-reater pressure is desired a secondary or booster or mpressor is also yoked for serv



Vertical longitudual section of Langley Field's midget wind-tunnel

ice, it being driven by a 1 s) horsepower induction motor. The information obtained from the wind tunnel tests that are made at Langley Field can be directly applied by the designers at the drawing boards who are working on new types of airplane m

on new types of airplane models. It is interesting to a furnst this diminutive air tun nel with the huge I runch wind tunnel described in our August, 1923 issue he French air tunnel has a wind tunnel 10 feet in diameter and a fan which



The world's largest pertable rivoter, whose design was necessitated by the turkine job for the Niagara power development

gives a maximum air current of 260 feet per second. The electrically-driven air fan alone is about 20 feet

Line Radio Communication

A PUBLICATION giving an intro-A duction to the subject or imeradio communication has recently been prepared under the direction of the Chief Signal Officer of the Army with the cooperation of the Bureau of Standards This pamphlet gives an explanation of how messages are car ried to distant points by radio frequency currents directed over or-dinary telephone lines or power wires The fundamental principles of radio and its relation to line radio selegra phy and telephony are discussed This pamphlet Signal Corps Radio Com munication Pamphlet No 41 entitled Introduction in I ine Radio Comm

A 29-Ton Portable Riveter

IN connection with the Magara I ally power develop-ment the problem arose of constructing the spiral shell for the 70 000-horsepower turbing together with The size of this assembly is extraor the penstock

dinary, and since it must hold water without leakage under a pulsating pressure of about 110 pounds per square inch the riveting of the plates squate inch the riveting of the plates must be if boiler quality. Owin, to the size and weight of the volute and instock a portable riveter is re-quired while the large rivets and plates call for one of high tonnage and long rach.

I here demands have been met by the design and c astruction if the

the design and c narruction of the huge machine illustrated on our cover this month. The total portable weight of this riveter is 57 750 pounds as against 25 000 pounds for its largest against 25 000 pounds for its integer portable predectsor. The frame is a single steel casting weighing 38 000 pounds the additional weight resides in the spindle and the riveling mech-

The surporting mechanism is so designed that when The sup print, metantism is so designed that when even hing the frame on the spindle or filting it upward or d waward fr me the triviatal the canter of gravity of the entire assemity hungin, upon the crane hook is neither raised nor it wered. The suspension beam (at top) the two vertical links the spindle housing and the top) the two vertical links the spindle housing and the spindle form a parall longram with eventum support at the crane hook directly above the center of gravity of the entire machine. Thus the friction of the bear ings and the incrita alone have to be over

come in si ifting the riveting jaws from one print on the work to another and two motors of two horsepower each are actu-ally sufficient for the j b! The tilting motion is limited to 30 degrees below the horizental but the rotation can be carried through the complete circle

Wired Wireless Broadcasting

Wired Wireless Broadcasting
THEFH was recently given the first
A demonstration of commercial wired
A demonstration of commercial wired
To the state of the state of the state of the state
Vork (17) The studio is not unlike the
wast radio studio. The output instead
tion is delivered to the electric wires pass
ing to the studio.
The wired wireless broadcasting comwired wireless broadcasting combacteric light users can anhear the for the

pany is planning an 18-hour daily program blectric light users can subscribe for the service in which case they are furnished with a compact receiving set which is attached to any electric light socket or outlet by means of the conventional plug The lowest gashertytion rate provides for a crystal set and head phones while the blesset zero provides for a lord unselve. highest rate provides for a loud speaker not If the Staten Island installation works out successfully both technically and commercially the idea will eventually be extended to other electric light systems.

Shifting Speeds With An Oil Pump

Some Details of a New British Variable-Speed Gear Without Gear-Wheels

By P. J. Risdon



THOUGH this system of what may be termed "gearless gearing" has been in use for some years for such purposes as ele-vating naval guns and for the steering

genr of ships, its application for other purposes has been restricted. At present, however experiments are being conducted in England with a view to its application to automobiles. If these experiments are successful the outcome will be a revo-intion in the design of road vehicles. The subject is there fore of such great and direct interest to all car owners that we shall endeavor to treat it in as untechnical a manner as possible for the benefit of those who are not

Supposing we have a vertical pin or hub on which a ball-hearing bicycle-wheel is mounted If the wheel is horizontal there is no tendency for it to rotate, but if we tilt the assembly to a sufficient angle the mere weight we tilt the assembly for a suncient angle the mere weight of the tire valve will be sufficient to move the wheel round until at last it will stop with the valve at the bottom of the stope. Now suppose that there is no valve and that the wheel is perfectly balanced if we then place a weight near the top of the stope, or impart a purely verticul pressure, the wheel will move round More generally, if a pressure be imparted at right angles to the plane of a balanced wheel or disk in any position, no movement takes place, but if we impart the pressure at an angle to its plane and if friction be ated or reduced sufficiently, we cause it to rotate

eliminated or reduced sumcently, we cause The gear that utilises this principle comprises essentially two units. One of these consists of a special design of multi-cylinder pump for pumping oil The other consists of one or more motors driven by consists of one or more motors driven by oil delivered under pressure by the pump. The pump and motor may be placed at any convenient distance (within reason-able limits) from each other and at any angle or different height, and the two connected by a pair of pipes for the flow and return of oil Alternatively the motor casing may be bolted direct to that of the pump casing so as to constitute a double unit, with the driving and the driven shaft in all neuent The only difference is that

in cases where the two units are separ-ated, there is a valve plate on one end of each, to which the ends of the two oll pipes are coupled We describe

the direct-connected type

The pump is housed in an oil tight case and comprises a thick solid cylinder called the "barrel" in which nine holes are bored concentrically so that it looks something like a large revolver barrel. The holes are not bored right through the barrel but from the dead end of each a smaller hole is bored connecting the bigger end of each a smaller note is horsel connecting the sigger holes with oval-shaped ports in the other end of the barrel. The barrel itself is keyed on the driving shaft and rotates with it. A set of pistons works in the cylindrical barrel holes and these pistons are coupled

to what is known as a "sacket ring" by connecting rods with cup and ball connections so as to allow of a certain amount of play, the necessity for which will be seen later. The pistons are bollow, and as the system is charged with all constantly circulating under high prescharged with all constantly circulating under high prescharged with oil constantly circulating under high pressure, the spherical bearings are always well lubricated. The socket ring is secured on the driving shaft by means of a universal joint, so that as the shaft rotates the socket ring rotates with it. The Socket ring bears upon a set of circumferential rollers within a cup-shaped a set or circumsterential robusts within a cup-anaped housing, the end thrust being taken by a separate set of conical thrust rollers. The housing is mounted inside the pump casting on a pair of trunnions, a vertical shaft and worm enabling the housing (and with it the socket ring) to be tilted to an angle of about one in two and one-half on either side of a plane normal to the shaft

one-may on eitner saue or a plane normal to the snarr Between the pump and motor barrels is a gumnetal valve plate with a pair of curved ports right through it. The center of this valve plate is hored and bushed to receive two sets of roller bearings on the ends of the pump and motor shafts. A hole drilled through the valve plate canalies oil to pass from the outer pump casing to the outer motor casing and vice versa, thus maintaining an equal supply of oil in each

maintaining an equal supply of oil in sea.

When charging the system, oil is admitted to the casings from a reservoir and the pump is run for a short time and any imprissment air is then released by means of air plugs which are replaced. The reservoir is then replications the representation of the represent

inclined rink causes it to rocirculates be tween the pump hydraulic pres-sure and serves as the working fluid Thegreater

The valve plate between the pump

ring, the more rapid the flow of oil and the more rapidly the motor shuft rotates,

In a set of gear tested by the writer an electric motor was coupled to the pump shaft and run at a thousand revolutions a minute. The pump socket ring housand revolutions a minute. The pump socket ring was then slightly titled and the motor shaft ran at one revolution a minute. From that, by increasing the till, the motor shaft was speeded up to a thousand. The accitet ring was then titled in the other direction, the speed of the motor shaft was full find in the other direction, the speed of the motor shaft gradually slackened down to sero, and the same procedure was a

An efficiency of 85 per cent is obtained at full-speed transmission. This efficiency drops slightly down to half speed, and then more rapidly at lower speeds. It will be clear from what has been said that, if we couple the pump shaft to an engine shaft, and the motor shaft to any other shaft.



closed type of electric meccanity for the totally ex-closed type of electric motors, necessitated in certain cases by the fact that motors have to be coupled up to the machines they drive. With the variable speed gear the electric motor and pump can be placed in any convenient position and the oil motor in any expused

pastion desired.

Another of its uses is as a hydraulic pump. A suction pipe from a reservoir to the pump unit would keep it supplied and enable it to be used as a variable speed pump for hydraulic work generally, its output being

point for hydraulic work generally, its output being automatically controlled if required. But of all uses, its application to automobile appeals. But of all uses, its application to automobile appeals on the control of the control of the property of the control nuty motor cut we have the clitch—at best a crude another than the control of the control of the control nuty motor and the control of the control of the automatical control of the control of the control of the hands of a beginner or an unskilled person. Thirdly there is the cartion shaft and a number of universal joints requiring frequent streetion. Forcity there is the theory is the helf-cartie quarting and differential. What there is the back-axie gearing and differential. What can be said of a device that will eliminate all the abovementioned objectionable fratures in automobile that is what their experiments lead the make dently to anticipate

centry to annespate.

A pump unit will be coupled direct to the rear end
of the engine shaft, a pair of motor units will be placed
in altereome at
the back axis,

with oil pipes and the pump unit, and each oil-motor will drive its own wheel shaft. In-stead of differ-



pump socket



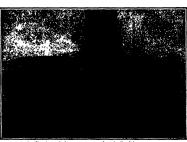
The gear with the outer casing removed, showing pump and motor complete

maining air is released by air valves on the valve plate

The gear is then ready for work

Let us now suppose the parts to be assembled within Let us now suppose the parts to be assembled with the casing, that the system is full of 0.1, that the pump shaft is coupled to a suitable prime mover such as an electric motor or an engine, and the oil motor shaft to another shaft that has to be driven. It is important to remember that the pump and motor that is important or remember that the pump and motor shafts are in no way connected, but are free to rotate at different speeds way connected, but are tree to rotate at discrema specus, if the pump socket ring be first adjusted by the worm so that it lies in a plane at right angies to the axis of the shaft, and the englue be then started and run at full speed, the worket ring and pump will merely rotate

g and pump will merely rotate without any pumping actions taking place and consequently without affecting the motor at all, so that the motor shaft will remain stationary if we gradually tilt the pump socket ring in either direction it will be forced to rotate in society ring in stitler direction; it will be forced to rotate is the library of the construction of the consequently it will add the construction of the construction



Application of the goar to an electrically-driven capetan

Clever Contrivances Garage Man

A LL specialized trades in which the A mackinist figures at all present scope for the investor to privide special tools and fixtures for doing very special jobs in a fraction of the time that would be required were these tasks to be performed on stand and lathes, office, or other spectrus. In no other line has this tendency gone further than in automotive construction and rejulthan in automotive construction and repair work, and in no other are the devices of the sort suggested in wider or more general use. That the factory would have gone in rather heavily for this sort of thing is far from surprising, but that the garage repair-shop can and does afford such a variety of special equipment would be a surprise to one who had not clearly visualized the enormous saving in cost which enables a machine to r itself despite that it is used but ce or twice a day.

A San Francisco garage was invaded by the SCHRYFFIC AMERICAN correspondent some time ago, and at least three machines h earned the attention of the found which earmed the attention of the reportorial pen and the reportorial cameru. The first member of the group below is a stand for testing and adjusting differentials. This ciever outfit is so arranged that it gives information about the differential which, in its

ence, could be got only by repeated road trials of car, with dismounting and readjustment of the the car, with dis the car, with dismonting and resolutified of the rear end between every two trips. At the right is seen the variable-speed motor that drives the differen-tial undergoing test. At the extreme lower left is seen the foot-lever for the prony brake which applies a retarding force to one side of the differential, and enables the operator to watch the complicated genering in action. Not alone in working economies, but in the absolute satisfaction with which differential adjust-ments may be made, this assembly is of extraordinary

Every owner has, at one time or another, had electric trouble of a nature requiring the testing out of one or more of the circuits on his car Sometimes this has entailed an actual dismounting of portions of the car establed an actual dimonuting of portions of the car and carrying of them indoors to the testing apparatus, at the best it has involved a good deal of inconvenience in bringing the steering apparatus to the car. Here we have the better way. A bettery is mounted in a testing period of the carrier of the carrier of the test pene from under the eden). In addition to the wheels, the lock carrier on its under side a creale making it easy to set it down on the framework of the car, or anywhere size for that matter. The lead wires of the battry actually serve as "redar", the mechanic drags the battery about by them, and in a jiffy he has it right the battery about to the carrier of the carrier of the carrier of the electrical condition of the car.

at the spot where its aid is required to learn the electrical condition of the car.

The third view shows the portable tool racks which follow out more or less the same idea as does the portable battery. Each of these stands has three racks, enabling it to carry practically all the hand tools likely to be required on any repair job. They wheel about



This circular computer is presented as an improvement upon the

from place to place, so that the busy mechanic always has his tool kit at his elbow, and is able to dispense with repeated trips to the other side of the building

with repeated rips to the other side of the outloned to get them. The same garage has a clever way of testing head-lights for conformity with the law—which must be more strictly enforced in California than it is in the average eastern state, if any necessity is ever felt for checking up a car's compliance with it. On one end of the building have been painted a series of vertical and horizontal lines, with two dots. The vertical line is in the correct position for centering the automobile whose lights are under examination. The two dots are then in such place as to correspond to the exact centers of the lamps. The line on the floor marks the centers of the lamps. The line on the floor marks the distance from the wall which the lamps should be for the test, and the horizontal mark on the wall indicates the dead line above which no light from the lamp should fall. This is sufficiently clear without a photograph, and equally clear it is, that with the lines properly arranged the assurance may be had that any lamp meeting the above conditions meets the state law

A Circular Slide-Rule

ALL technical calculations require answers to an accuracy consistent with the data 2, 3, 4, or in very fine work, 5 significant places. For this purpose very fine work, 5 significant places. For this purpose the graphic-log method is by far the best. But the shirinkage and warrange of the ordinary wood-celluided months to master A new, all-metal, circular computer that utilizes the logarithmic principle, but is built like a transit or companes, and convertible for desk or pecket, has been revenly perfected by Louis Boss, at (vilu-cipation of the property of the property of the property of configure and inagelous inventor of San Francisco. This computer is shown in the illustra-tion It consists of two scaled, rotating disk, read by a redial hair-line engraved under the lockable arm. The computer is five inches in disaster, while the inner dial is four inches, so that contact scales are 32% inches long, like upper scales of a 23-inches of the contact are also as a 23-inches long, like upper scales of a 23-inches of the contact are a scale of a 23-inches long, and a 23-inches long, like upper and a contact and or the computer are analogous to the upper and lower movements of an engineer's transit, a thumb-lock, as on a transit, con-trols the outer dial, while a special desk-clamp serves, like a tripod for the transit clamp serves, the a tripod nor the trainant or compass, to increase accuracy and convenience, and to permit one-hand operation, leaving other hand free for writing down results. Double readings, answer and proof, like the double verniers on a transit, ellminate mistakes and errors, instrumental and personal The dials are graduated directly on heavy metal, fine as a transit, but in purple color easy to read and soft to the eye. Made wholly of metal, the computer is unaffected by heat, cold,

dius and direction, nakes readings appear burger than ordinary typewriting, increas-ing accuracy of interpolations. When direct,

The magnifier, adjustable in forms, re-

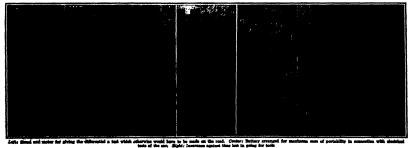
the ing accuracy of interpolations. When direct, less precise readings are destreed, a touch of the finger turns the magnifier saide, and it is instantly deschable for experience we first use of either magnifier or desk-clamp is optional, both are harstly deschable. The loss-cleri teather case, applied with standards 38, 20% sheets, in a wariety of rulings and forms, folds to 5.x7, so are to 81 coat, breast or

neck pockets.

The key for operation is given on the arm, in plain sight of user. When any problem is set under the hattine of the arm, a long arrow automatically points to the answer, while a short arrow shows the proof. If the answer, while a short arrow shows the proof. If the problem inconver three items, two knowns are set opposite each other, and opposite the third known the naver appears. Reject numbers of constunct, can naver appears. Reject to the property of the property great convenience in heavy, tabular work. Trigono-prest convenience in heavy, tabular work. Trigono-toric, logarithmic and exponential problems are solved just like plain numbers, by using the special scales as inhelied on the earn, for that purpospecial scales as inhelied on the earn, for that purpospecial scales as

Stave Trade in Foreign Countries

FOR the benefit of American cooperage exporters, the Lumber Division has just lauved the publication "Stave Trade in Foreign Countries." This is a compliation of reports from American consuls and repre-sentatives of the Department of Commerce in various foreign countries. Being replies to a questionnaire sent out by the division, these reports over the importation, domestic manufacture, specifications, and uses of cooperage, as well as indicate how the import rade is handled. In addition, statistics on the cooperage experts of the Vnited States and imports and exports of the Vnited States and imports and exports of other countries were prepared by the division. Statis-tics on United States exports for 1922, which were only recently available, have been added as an appendix.



tents of the ear; Sight: Insurance against time but in galar for took Some of the ingenious special fixtures with which the labor item is cut in the up-to-date garage

SCIENTIFIC AMERICAN

FIGUR 28 FOUND 2014 Y. CALLILLOCA

The proposed of the Threshold Control of the Threshold Contro

An extension of the management of an anticontrol of the property of the prop

desirable, judged by the standards of strictly

MEANAGED parents. He rake is \$84,481,184. He cost to the construct is \$211,002,000

The unusal catch of the booling varieties of fish in the United States. The total is over

Feeding the Automobile Engine

Purdue University Investigation of the Proper Treatment of Mixture that Goes to Carburetor



IIIE FUEL problem is no longer merely that of sindings a supply of flittle combastible of sindings a supply of flittle combastible of sindings as supply of flittle combastible combastibl

Car, truck and tractor must today use the heavier

The trind and tree is must good by the heavier feels and leave the lighter ones for the plane. These heavy fuels grow heavier each jear, they continue to how in our arts, but with a long take of low efficiency more in our arts, but with a long take of low efficiency sensetimes ask whether the Otto cycle is permanently suited to the fuels of today and tomorrow. The Otto cycle may ultimately be replaced, but for the contract of the contract of

over, what is needed is the heat equivalent of vaporiza-tion, after the boiling point is reached, and in no event tion, after the boiling point is reached, and in no event can we raise the temperature of the fuel above the boiling point of its highest fraction Preheating the air is very useful on the cars now in operation It does not interfere with carburetion but

operation It dows not interfere with enduration but cats down volumetric efficiency and power delivered It stress good milesges, smooth running, distinstation of the good milesges, smooth running, distinstation of the good milesges, smooth running, distinstation of the good milesges, smooth running, and the silght feet good milesges of the decrease in the man difficiency at the highest respectatives. The situation of the milesges of principality from healths, the state of the principality of the silght situation of the silght situation. Again the foul must stay below the boiling point of its lightest fraction. No heating of the fuel is at a silght silg

From the theoretical viewpoint, healing the misture as advantages over the preheated-air method. Heating

is achieved at lower pres-sures, and the degree of heat may be more variable with-out affecting the carburetor If the minimum temperature If the minimum temperature is sufficient for idling, the maximum will not cause bad effects at higher loads and speeds If skill is not exercised in the design and placing of the heating surfaces, however, the power loss is as great as with the preheated attentions. air method

air method

Heating the fuel after
metering is more nearly the
ideal method, possessing the
good points of heating the
mixture and being free of
the bad features of the other ones. Having been metered, vaporized if necessary The temperature of the vaporiztemperature of the vaporiz-ing surfaces, when exhaust heat is used, never ignites the fuel. The air is barely heated at all, while the fuel

heated at all, while the their is wholly taporised. When the two are brought together, the temperature of the final mixture approximates closely to the theoretical milnimum, so the power loss is indignificant. Again are must be excreded in deading, and wet portions of the fuel must be allowed to pass through the separating device or acceleration will be accomplished only with

Heating the fuel and part of the air after metering is a modification now in use in some cases. The final temperature of the mixture may be quite low without excessive deposition. A very delicate metering device must be used, however, and as vaporization is entirely from the heated walls of the hot area, the temperature of these must be very high

The Engineering Experiment Station of Purdue Uni-



The fuel is weighed on the balance and siphoned from be to carburstor. The panel at the left provides electrical in for controlling measurement of speed, time, air and fuel. The details of the centrol table

versity has made extensive tests to show the relative versity has made extensive tests to show the relative merits of prehented air and of the various hot-spot nethods which comprise the alternatives, as well as to bring out all possible dair regarding fuel preparation and combustion, fuel-air ratios, etc. The accompanying illustrations show in some detail the apparatus used heating at the outside bend of an enlarged intake pipe. An inspection glass of ample diameter was placed at the top of this section, so that the spot could be easily observed, and the dryness of the mixture and the size of the fuel globules noted.

observed, and the dryness of the mixture and the size of the hug slowless noted. On the hug slowless noted, or the hug slowless noted that with suitable attention to the best operation of our extomobiles and trucks, at least 25 per cent of the fuel used in the automotive industry could be conserved. This would come to 1980.0000 galicaes, worth, at current prices, or the control of the control

where from 40 to 200 per cent. It is deserved that at least half of the curs now operating are susceptible of material improvement in fuel utilisation. In support of their conclusions that the hot-spot method affords the best prospect of meeting future con-mitted affords the best prospect of meeting future con-dition, the low engineers refer to the fact that while does not be the support of the control of the con-trol of the control of the control of the con-trol of the control of the control of the con-trol of the control of the control of the con-trol of the control of the control of the con-trol of the control of the control of the con-trol of the control of the control of the con-trol of the control of the control of the con-trol of the control of the control of the conmanifold, less attention has been diverted to the fact that as much or more power loss is possible from the decrease in volumetric efficiency that follows from poor occurrent are number of contracting that notices from post-ture of these surfaces. With the very crude experi-mental hot-pot used in the tests, a metal imperature of 500 degrees at the hot-long tops as dry mixture at half load with an intake presence of 11 inches of the contraction of the contraction of the contraction of the factory at low speed folling with a metal temperature of 300 degrees and 20 inches of vacuum? The problem of manifold dealn resolves inself into the one of funda-mental data on raises of feel vaporisation at various at all operating conditions, and the vaporisation of the fuel in its relation to distribution to the several crinders, and the utilization of ingenuity in the design of the upportsing surfaces. If more analytical methods of the upportsing surfaces, if more analytical methods of the contraction of the contraction of the proportsing and the contraction of the manufactors and the contraction of the manufactors are contracted as assume such large proportions are some large proportion. dection of heating surfaces and unfavorable tempera-

fuel of the future will be heavier than that of today This granted, the statement can be made that manifolds will satisfactorily vaporise and distribute the mixture

and distribute the mixture as well as is done today, or better. The high shandlesp now and in the future is starting. When a starting device is used that will immediately deliver the mixture sufficiently dry to the cylinder, no approbassion need be felt with regard to the good performance of the sughes after it is warmed.

Street Lighting
THE Bureau of Standards
I is making a study of the A is maxing a study of the various systems of street lighting used in cities and towns throughout the coun-try Seven hundred and forty-

try flerweb hundred and further had described heavesthe bur mendefaultite he we have a mendefaultite he we have needed for copies of their heave here received on trave-lighting quintennantive mender of the copies of their heave here received on street-lighting parameters. The test of a number of the manyer companion that has been cheriched from 100 of the hanger companion that he had been prepared in perimburary forms of street-lighting seewing had been prepared in perimburary forms.



The engine, air-heater, air-meter and centrol apparatus for the carburction tuets described herewith

in these tests. The engine was direct-connected to an electric cradle dynamoneter through a suitable universal joint. Means were provided for measuring all temperatures, pressures, etc., and all tests which were to be compared in any series were made with the same throttle opening and load. In testing the "hot-spot" operations the hot spot was of experimental design,

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Various Arts and to Patent News



This attackment to the knife enables the h stess to serve the cake in complete

Investigation has come to the receive of it has not been been to the host of heatest whose lot it is special tool for this purpose is offered, but rather an attenhent for the ordinary knifts. This attenhent, much like a two-times drvid in general cultina, slips knifts. When the cake has been cut, the interest of the cut of the c

Oxidized Kerosene as Truck Fuel THE solution of still another industrial problem has been undertaken at the

research laboratories of Carnegie Insti-tute of Technology, Pittsburgh, in experiments to determine the relative efficiency of kerosenes and oxidised kerosenes as of kerosenes and oxidized kerosenes as fuels. In accordance with the policy of the institute to link up its educational facilities with modern industry, the De-partment of Chemical Engineering has been conducting a series of tests to debeen conducting a series of tests to de-termine the relative merits of various oils as unable feels. The completion of this important work about 00 a long way toward solving the problem of this important work about 00 a long way toward solving the problem of 00 a long way toward solving the problem of 0 a long the 0 ft a new finel. According to a report by Dr. J H James, head of the department conducting the experiments, oridised kerosence cause less "knocking" tenden-cet than straight kerosence when used in that cardined kerosence have approxi-tate cardined kerosence have approxi-mately the sume power development as mately the same power development as ordinary kerosene in spite of the fact that their thermal value is one-eighth



Detice for determining the amount of

less. The James attributes the efficient w less. Dr James attributes the efficienty of the oxidised kerosenes to the better "clean up" in the combustion of these partially oxidized fuels. The success of the experimental work at Carnegle at the experimental work at Carnegie at this stage gives promise that oxidized kerosene, which is manufactured by cata lytic oxidation from low grade petroleum, may become a useful fuel in the future Its properties may cause it to be use Its properties may cause it to be used industrially in kerousen empioes or blended with gusoline for use in gaso-line engines. Although it has a some-what lower fuel value than ordinary kerossen, one of the most ravorable fea tures of its effectiveness is that it under goes much better combustion in the in-ternal combustion engine.

A Heat Economy

NONE of the advances of recent years in the manufacture of cement is of greater importance or interest than the utilization of the hot gases escaping from the kilns to heat the boilers that supply the kims to heat the content that supply steam for the operation of the cement-plant power-house. For years an im-mense amount of energy was lost in these gases, which reached the stack at temperatures of ten to fourteen hundred degrees Fahrenheit in plants using the

degrees Farrement in plants using the dry process of manufacture Many problems stood in the way of utilizing this heat, but great progress has been made, with the result that a has been muce, with the result that in number of plants are now producing from 50 to 100 per cent of their power requirements through waste-heat bollers Such installations require heavy expendi-tures, but the adoption of this means of saving fuel will undoubtedly become

saving fuel will undoubtedly become more general as time goes on. These waste guess consist largely of introgen from the air that furnished oxygen for combustion in the kilms and of carbon dioxide driven out of the lime stone during the burning. In plants on ploying the were process, waster-bant following the way to be the constant of the constant of the constant of the process, waster-bant following the way to be strong and the process.

Magnetic Assaying

THIS device is used for quickly reduc-I mg a sample of ore so that the man-netic iron percentage cm he securately computed. A sample of ore is placed in the glass tube which has been pre-viously filled with water. The carriage and tube are then automatically rocked, the carriage bearings being placed at the poles of the magnet. A stream of water passes through the trub, weaking sway, the bearing the contract of the carriage is not poles. When the washing is completed, the magnetic assay is made.

The Latest Auto Lock

HEBLWI'll is illustrated one of the latest devices for defeating the au-tomobile thief It consists, as the picture indicates, in a simple lock that is at tached to the steering column, beneath the wheel When locked two plungers project upward and firmly hold a spoke project upward and firmly hold a spoke of the steering wheel between them Lock and plungers are of drop forged, case hardened steel, heavily nickeled, the lock itself is a cylinder affair of the familiar model. The lock is so con the lock itself is a cylinder affair of the familiar model. The lock is so con structed that it will not ratile, and there is no danger of its falling into locked position while the car is running

A Magnetometric Method of Determinating Carbon in Steel

A n interesting account of a magneto-metric method for determining carbon in steel was presented by Gunnar Mainters at the recent annual meeting of the Swedish Metallographic Society The new method is based on the fact that the magnetic properties of steel undergo a striking change as the percentage of carbon is altered. Though even other components of the alloy evert an effect of companies of the may ever an enter of their own, this is, as a rule, incompar-ably smaller and, accordingly, does not greatly affect results. Moreover, inas much as Mr Mainberg has accurately studied this effect, it is readily accounted for An apparatus designed by the ex-perimenter and known as carlsometer enables this method to be applied to the testing of steel samples in actual practice and, being both rapid and reliable in working has been adopted by some of the leading Swedish Iron works for checking the progress of steel refining

Soldering Without a Soldering

COLDERING without the use of a S'copper' produces neat and rapid results, says Bart Medi Worker The method is to heat the parts to be soil deered, by means of a torch flame, until they are just but enough to "sweat" in the soider and not hat enough to make the soider run off. The shilly to get the soider run off. The shilly to get the soider run of The shilly to get the soid of the shill be soider and shill be shi Tron wire solder is employed, with the weak flux, and an acid brush. The surface to be soldered should be kept horisontal. If gobs of solder form, they may be wiped smooth with the acid brush and wipeg smooth with the acid brush and the surface heated again, but when skill is acquired, the brush can be dispensed with altogether. No wiping cloth is needed The only drawback to the method is that considerable practice is



By means of projecting plungers that engage a spoke of the wheel, this lock engage a spoke of the whee makes the car secu

necessary to become skilled with it. However, not only is it much more rapid itoweer, not only is it much more rapid than the usual was of soldering with an "iron," but for some kinds of work the results are much more desirable. It is particularly effective where smooth soldering is wanted as for example in the gasoline tanks of automobile touring the gasonic tails or automobile toring cars but where it would not be advisable to file off the surplus solder because by doing so you would be very apt to scratch the surface of the metal itself.

Wood Poles for Transmission
Lines
A GERMAN firm has lately put on the A market a type of wood pole, which should have a life of at least 40 years. The upper portion is of the usual kind while the base is of impregnated hard wood Departence shows that impregnated beech wood skepers have a life exceeding 87 years and as poles are not subjected 37 years and as poles are not subjected to the same mechanical shocks, the makers anticipate a longer life than this for their poles. The two portions of the pole are bound together by wrought-iron strips, which are bolted together.

The Window Bed

No longer is it necessary to provide an expensive sleeping-porch for the benefit of those who need fresh air at

night
The window bed here illustrated can The window bed here illustrated can be rolled out of any window, with per-fect safety. It is in reality a completely screened cut, mounted on a metal frame and supported from the floor much as



Sleeping out of doors without a sleeping porch



The simplified lawn-mower

small fron beds are supported When small from beds are supported when rolled on its frame out of the window, it is held in place by chains I or camp-ing the bed like frame is not used, the springs restling upon the supports that hold them to the frame of the house Under such circumstances, the sleeper is about six inches from the ground

Keeping the Kitchen Range Bright and Shiny POLISHING the kitchen runge is not no essential as keeping it olled against the invasion of rust. This fountain the invasion of rust. This fountain brush cleans and oils at the same time the flow of oil being adjustable from the oil continier which is in the top of the holder. A slight pressure of the thumb on the plunger, as illustrated, gives regul lation to the precise amount of oil

Funnel, Filter and Dipper in One THERE kitchen utilities in one is the convenience now offered the house A convenience now onered the nouse-keeper whose space is limited Funnel, filter and dipper are consolidated into a single tool illustrated doing duty as a funnel For conversion into filter or dipfunnel For conversion into filter or dip-per the circular attachments are used which in the photograph are shown loan ing against the bottle Two of these are of wire a recaing one coarse-meshed and one fine when placed at the extraor to the tapering part of the funnel, they obviously convert it into a filter And when it is to be used as a dipper the solid plug is used in their stead and the centents of the bowl instead of running



The insertion of one of the circular plugs converts this funnel into a filter or a dipper

A Simple and More Compact Lawn-Mower

AGRIATLY simplified laws mover
Ahas been recently introduced by a
bilithigan manufacturer. It is claimed
that the device cuts and trims both tail and short grass at the same time. It is lighter in construction than the average lighter in construction jaban the average inav mover, weighing only sever pounds Decume of the fact that there are not many where it at the side, it is possible to ingress where it at the side, it is possible to increase the content of the side o

that the grass is cut evenly wherever



Convenient device for cleaning oiling the kitchen range

the mower is quided. The cuttern are adjustable so that the grass may be cut to any desired height. At the sides are too sand wheels, only two inches in a constant which is the constant wheels are the constant wheels are the constant and take the place of the larger wheels used on other types of mowers. These wheels have gested toolt edges which was the control of the constant wheels are two guards with post in road of the whoels are two guards with post in road of the whoels are two guards with post in the control of the mower and insure that it will be held at jost The cuttern of not not not present constant of the control of the cuttern of not need researching. the mower is guided. The cutters are The cutters do not need resharpening but can be replaced at a small cost

Solving a Printing Problem in the Composing Room

TNATIGAL of a certain printing problem in that often arises is the conventional their blook of large site, with interest the printing problem in the printer the option of setting up always the printer the option of setting up the check three times or of printing three impressions upon the sheet, one arree mother, from the single plate The first alternative is obviously an exposing the control of the printing three proposed in the printing three printing the printing that the printing register

A blind inventor of Fort Worth, Tex.,

A blind inventor of Fort Worth, Tex.,

K J Dullahita, has steered a successful
ourse between Scylla and Charybdis
course between Scylla and Charybdis
this word, we should explain to the
unitates, standing for the pestal frame in
which the compesitor locks his type hefore sanding it to the pestal SK, Dullafree sanding it to the pestal SK, Dullamore standing to the pestal frame in
which the compesitor locks his type hemad an inner one. The outer class serves
merely as a truck for the hance one to
move in The inner one ourries the
type, which is see but once the three
type, which is see but once the the three
is mounted in the outer one by micromore
is mounted in the outer one by micromore
tex-rows, no pitched that one emplete

turn corresponds to a spacing of one pica. Thus it becomes possible, after a single impression has been run off pica. Truis it becomes possible after a single impression has been run off with the inner chass in its upper position, never it down to an interseedists position and run the sheets through again for the second check, without a thought for the problem of register, in the same way, the linner chase is screwed down all the way for the third serve the country of the c

and bottom most impression

We have described its operation only
for the case where three identical printings are to be made, but obviously the
chase can be built for any desired

The Circular Washboard

K ITCHENETTE housekeeping is

A brought one step nearer the ultimate goal of simplicity by the washing
outfit illustrated The washboard is made circular in section, and a pall supplied of corresponding radius. For washing the two are fitted together as in our illustration for storage or packing they are left that way, and when the bucket is needed as a bucket, the washboard comes out With the aid of this combination and a chair, one washes with convenience equivalent to that given by

Photography Makes Charred Man-uscript Legible

uscript Legible

A N important discovery, which practically solves the problem of restoring written or printed records made illegible by the carbonising effect of hest under partial exclusion of atr, has recently been made by M R Davia, one of the research workers of the Bureau of Weights and Measures in Washington D. C.

Handwritten, typewritten and printed



The adjustable, three-positioned chase that cuts the cost of printing checks, three on a page

sheets of haper were used in the experiments. They were subjected to conditions similar to those to which decrements succeed in frequent subjected to conditions similar to those to which decrements succeed for the subject of the su



A space-conserving wash-day combi-nation for the crowded apertment

vriting on the reverse side. Rapid and nedium plates gave the best results, while slow plates gave poor results. When rapid films were used instead of

When the parts are not become of the parts are the parts and the parts are parts are proposed for the parts are part

The Flashlight Goggles

The Fashlight Goggles
COVENET/ONAL dashlights are all
open to the objection that the user
must give up one hand to holding the
flash, or diss must rig up a temporary
must give up one hand to holding the
flash, or diss must rig up a temporary
done is essentially a two-handed one.
This is not particularly satisfactory,
single point instead of following the work
as it should. A very clewer escape from
his predictanent it seem in the fashlight
the lamp is between the leases, where it is
so out of the lise of vision, and a shield
is provided to provect the syms from the
battery, not immediately strateded to the
lump, but in the user's pocket and joined
by wive to the lamp Covioust, the
at which the wearver's gase is directed.





Novel hand-power vacuum pump

A Gas Mask for the Miner

CAS MASKS have been used in several of the industries since the example of the World War taught some four millions of Americans their efficacy against polson gases. Firemen are now regularly equipped with them. Now comes one for the miner, called the "Self-Rescuer" Obviously, it is not the "Self-Raccuer" Obviously, it is not toe exact model used in the treuches. The miner iss no need of one so elaborate and cannot be bothered with one so clumey But a manufacturer in Pitts-burgh has put on the market a small though efficient mask that may be curried on the belt of the workman and which will not get in his way or be so which will not get in his way or be so bothermouse that will neglect to carry it. Ex-secrice men will sullingly recog-nase the old nonthiptees of rubber to which is attached by a string the same of the nontrile together four seconds after someone shouted, "Gast." The rest after someone shouted, "Gast." The rest securities only four and a quarter by these and a nugarrely puse and quarter by three and a quarter by one and one-half inches and is filled with a chemical known as Hopcalite. This chemical con-verts the deadly polson carbon monox ide known to miners as "afterdamp" into carbon dioxide, which is the sa ous gas that puts the firs in sods



Since the necessity of using the Seif-Rescuer in a mine may come but once in a lifetime, it was necessary to pro-vide a method of protecting the consister against dirt and abrasion while worn during very lengthy periods of time Ac-cordingly, the mask is covered with a seal of metal which may be ripped off every cealfy as it is strached only with very cealfy as it is strached only with against any concentration of carbon meantide that is likely to be encountered memoxide that is likely to be encountereduring a period of 80 to 70 minutes.

Vacuum by Hand FOR small work, the hand vacuum pump illustrated, which has just been put on the market, affords a very economical substitute for a power pump. In addition to the standard and recognized uses for such an outfit by chemists, doc-tors, dentists, etc., the manufacturer sug-gests other fields in which it would give gests other helds in which it would give spood service. Thus, it has been found possible to line iron pipe with lead by inserting the end of the pipe in molten lead and applying a moderate vacuum to the other end. The suction fills the pipe with the hot lead, and the latter coals where it is in contact with the pipe with the hot lead, and the latter cools where it is in contact with the iron When the waccum is released the motion core flows beek into the crui ble, the motion core flows beek into the crui ble, the procedure would, of course, not be warlable for a long pipe length, but would do very nicely for a short one Another application like in the ex hausting of liquide from inaccessible places—of water from a steam tray, wit

places—of water from a steam trap, etc. The pump is practically designed with reference to this sort of thing. The vacuum is created first in a glass bottle, and carried from this out along the line. Anything in the way of liquids that the suction brings home will enter the bottle rather than the pump, and will stay there until the bottle is filled, hence the convertes was consults. apparatus may actually be used to ex haust acids. The pump is supplied both with and without the gage



Gas mask that protects the miner against carbon menoxide

A Bell Motometer

THE standard motometer with its red I line and its dead line above which the red must no go, is a great surve of re-pair bills for the careless driver. But it does have to be watched, and it there-fore leaves something to be done in the way of giving automatic warning of an overheated engine. The bell attachment for the radiator cap which we show takes the additionals the strength of the bell sets are a therecoast; the surface is nunc as snown on the illustrations, the bell acts as a thermostat, the spring is released when a certain temperature is released, and only a totally dest chauf-feur has any excuse for not knowing that trouble awaits him if he doesn't stop and investigate.

Carrier Current Makes Long-Distance Lighting Possible TXFHRIMENTS shade at the plant of L. the General Electric Company at Bant Lyan, Mass., proved, according to oficials of the company, the practica-bility of sending high frequency carrier current, such as is used in radio com-

munication, over electric light feed cir-cuits to light relay lights as far as four niles away from the generating source of the current

Ordinary 110-volt household lighting Ordinary 110-volt household lighting current was converted into carrier cur-rent by means of a high frequency gen erator The output was superimposed upon the 4400-volt house lighting feeder

upon the 4400-volt house lighting reeder current running from the plant to Nahani, Mass, four miles away Two relays of electric lights at the Nahani card of the line were set to dif-farent carrier frequencies. When the carrier current frequency coincided with the attunement of one relay of lights they would light up. But hear the carthe attunement of one relay of lights they would light up. But when the cur-rier frequency was attuned to the other relay its lights would glow. The currier current was transmitted over the lines

without interfering with regular lights. Tests have shown, according to the company, that any number of relays of lights attuned to different carrier current frequencies can be operated individually



Coll-spring shock absorber of unnaual pattern

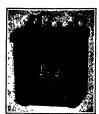
Another Shock Absorber

SHOCK absorbers are offered in numerous styles, but few are de-signed so as to become so integral a part of the suspension system of the car the one here illustrated Taking the the one here illustrated Taking the place as it does of the spring hangers and of all other connection between the spring and the cav, it has the direct effect of adding to the length of the spring. Not is this addition measured by the mere overall dimensions of the device, by virtue of the positive action of the coll spring, the car spring works like one several feet longer than is actu-ally the case In addition to the coll spring with its cushioning effect the

Getting at the Milk Bottle

FITTHY as it was, the old fashioned tin cap for the milk bottle, with its at in cap for the milk bottle, with its spring clip, was always easy to get off, and it never gave the housewife a milk bath as an incident to its removal. Ever since recognition of its unsanitary character forced it to yield the floor to a card or paper cup that is used once and then discarded, the problem of easy and aate removal of the latter has been plaguing our inventors. The solution which we show at the bottom of the adjoining column appears to have merit An aluminum cap the size of the bottlean auminum cap the size of the bottle-top has two sharp prongs on its under side. It is placed over the bottle-top, the prongs necessarily piercing the paper cap. Then it is tilted off, and necessarily cap. Then it is tilted off, and necessarily it brings the paper cap with it, while acting as a shield against the geyser of milk which sometimes comes away with

The Crossing Signal That Cannot Fail
PROGREEMENTS for an electric signal protecting a railway grade crossing are severe. It must be capable of alternately opening and closing two of internately opening and closing two electrical circuits many millions of times, without a change in the contact adjust-ments and without causing rapid dete-



The working parts of the grac crossing signal that can fail or on the side of safety

rioration of the contacts. The most recent attempt to meet this deman uses a totally different principle from contact, these members are enclosed in a glass tube partly filled with mercurs

This apparatus consists primarily of This apparatus consists primarry or an armature, oscillating freely between the poles of an electromagnet. To this is fastened a pendulum, which is oscillated in one direction by the electric current, whereupon the current is automatically turned off and the pendulum constructions of the control of the co returns to its original position gravita tionally This cycle is repeated auto-matically from 80 to 60 times per minute. On this pendulum is mounted the contact tube mentioned above

Without going into too great detail, it may be said that the contact is made in the mercury when the pendulum is in either extreme position, and broken while it is swinging from the one to the other The device controls two (or more) red lamps, in such a way that first one then the other lamp is lighted. These lamps are in such positions along a circular are at the crowing that their successive flashing gives the effect of a single red hump, swinging back and forth And the device meets the requirement that if it fails, it must fall on the side of safety for if the pendulum cease oscillate, it must return to the vertical



The splashless milk-bottle opener



The coiled spring in this driving cushion gives resiliency and ventilation

position under the pull of gravity Then one of the contacts remains permanently closed, and one or more of the red lumps continuously

It will be understood that this signal works only when a train is approaching, the track relay supplying the impulse that sends current to the magnet and

A Crude-Oil Motor without a Carburetor

ONE of our German correspondents sends a description of the motorcycle outfit illustrated herewith, jumping right into the heart of his subject ing right into the heart of his subject with the confident pronouncement that "Herr Joseph Loewy has after 15 years' work solved the problem of a crude-oil engine for the motor cycle", and leading a human touch by informing us that, a numin touch by informing us that, when the inventor first led his produc-tion forth in public, "the crowd was extraordinarily large, in spite of the very cold weather" When the contribu tor gets down to actual description of the apparatus, we learn that it carries no separate carburetor, but that the mix ing of the gas takes place in the cylinder jacket, where we are accustomed to look for the cooling water. Only the upper part of the cylinder is ribbed (apparently for air-cooling), the lower half being surrounded and cooled by the inflowing fuel By this means the heavy crude oil, ordinarily difficult to thin or to ignite, is so strongly heated that when sprayed through a nozzle it enters the cylinder without any eddying The motor works on a two-struke cycle, and develops about one and one-half horsepower. It is started on henzol, and run so for the first two minutes until it gets warmed up. In this connection great importance is attached to a two-duty adjustable nozzle of extreme simplicity, which enes the switch of fuel to be ma no trouble at all. The account closes



The grease goes into the channels of this waffied frying pan, rather than into the food

with a personal touch, Herr Loswy is a "self-made mun," this linglish phrase apparently having been adopted by the Germans. Also, he is apparently not looking for capital to develop the ma-chine, since our correspondent's final sen-tence pictures the investor as "mashe to save himself" from the importunate conventions who are entired to shave in talists who are anxious to share in his prospective profits.

Motor Cushion a Colled Spring
THIS motor cushion for the convenience of motor cus drivers is made
of an 80-foot colled spring wound
spirally It gives a good cushioning
effect and at the same time maintains an
air space to permit heat from the body
to sevens. The cell he clearly covered air space to permit neat from the body to escape. The coil is closely covered with a woven textile allowing the circu-lation of air beneath and behind the back of the driver. It is said to be an

Transformer Oils

THERE cils tend to form sludges, teither slowly or quickly, according to the nature of the oil i. H. Illil de-scribes (Siccirical World, New York) several tests that may be applied to the oil to determine its tar-forming prop-erites, and gives references to original papers, where the description is mor

The Foot-Lock Vise

E VERY vise user has experienced
difficulty in holding the work. If it
is possible to serve the jaws down hard
on the piece in the first piace, after working with it for a while it will be found
to be loses again. A very effected vise
lock is illustrated, which works with
the use of the operator's foot. It is not the use of the operators must be actually built in. A kick upon the pedal locks the work behind a pressure of several hundred pounds, and a kick re-leases it with certainty and despatch. The long lover attached to the pedal is the secret, the compounded purchase which this gives enables the jaws to be ed tight against the work, no mat ter what the shape of the latter The bring the jaws into approximate engage-ment with the work after which the foot-lock is called in to clinch the matter

Fire Tests of Roofing Materials

THE Bureau of Standards has pre-pared a program of tests, equipment is being procured, and test specimens is being procured, and took specimens constructed for conducting a series of fire tests of roofing materials with par-ticular reference to the relative merits of wood shingles and prepared roofing. A conference has been held with rep

Recently exhibited German motor-cycle engine, running on crude eil and dispensing with a carburetor

complete It is certain that the sludgeformation is a form of oxidation. One company has therefore introduced a type nsformer in which the oil is ered with a layer of inert gas, usually nitrogen A cyclical process, dependent on temperature and pressure, takes place, by which the nitrogen is driven out or sucked into the transformer Any incoming air passes through an automatic valve, and is then deprived of oxygen and moisture, it therefore becomes dry nitrogen. Thus the ôil, being in contact with nitrogen, does not oxidise, the layer of nitrogen also minimises any explosive

The Greaseless Frying Pan

RYING is an operation that requires
grease, but the victim of the frying
pan knows all too well that he gets too pan known all too well that he gets too much of this grease in the finished food. How can bucon, pork chops, sausage, lamb chops, eggs, etc., be fried in grease and brought to the table free from grease? The inventor of the waffod funishments herewith the grease? The inventor of the waffied frying-pan herwith Illustrated has sought to nawer this question, and so sought to nawer this question, and household for a year with very good results. The flat expelled by the frying delicary flow into the chamals and stays there, where the food gets all the benefit of its presence without becoming attention to the control of Alleton, Mass. to the Inventor.

entatives of the wood shingle manuresentatives of the wood shingle manufacturers, the prepared roofing manufacturers and the fire underwriters, at which agreement was reached on the methods of testing and on an outline of the program of tests.

Diffusion of Nitrogen Through Various Liquids

ONE of the difficulties which the Buliquefaction of hydrogen is the securing of hydrogen of sufficient purity. If other gases are present, they become frozen at a temperature higher than that at which hydrogen liquefee. This clogs up the apparatus and stops the process. The storing of hydrogen in any kind of a gas holder is, therefore, a matter of some difficulty because gases are very apt to diffuse through the liquid seal used in the holder and become nively strike their best because gases are very apt to diffuse through the liquid seal used in the holder and become nively strike their guses are present, they become frozen at the holder and become mixed with the

Experiments were made during the past month on the relative rates of dif-fusion of nitrogen through glycerine, mafusion of nitrogen through glycerine, ma-chies oil and water. It was found that the rate of diffusion through glycerine is very much lower than through water or machine oil. This was to be ex-pected because of the extreasity low solubilities of nitrogen and other gases in giverine. The Bureau now proposes to scaping glycerine as a seal for the gas-tos seption of the temporary storage of nours. Mythory. pure hydrogen.



The vice that uses foot-power and compound leverage to jam its jaws tightly upon the work

Colories Waterproofing Materials for Stone

INVESTIGATIONS are now under way at the Bureau of Standards covering the action of frost on building stone and on the value of colorless waterproofing materials with which to protect the sur-face of stone structures. During the last ince of stone structures. During the last month the series of exposure tests on colorless waterproofing materials, having for its object the determination of the relative durability of these treatments relative duribility of these frontments under weather conditions, has been sup-plemented by a series of tests to deter-mine the efficiency of the different water-proofing materials in preventing decay

Crystallization tests are being made on waterproofed specimens to secure a can waterprisoned specimens to secure a comparison between treated and un-treated specimens. Waterproofed speci mens have also been exposed to the weather and will be tested after a considerable period of exposure

Painting with a Wheelbarrow

Painting with a Wheelbarrow

CalifolniA's highway combined on

Lis now painting a white line down

to now painting a white line down

Francisco as a anfety precaution to

notorists. A very simple and efficient

device is used for this purpose. It con
state of a paint receptacle certed on a

three wheel hand truck, with a hose

leading from the receptacle on a paint

device just back of the front wheel This

break paint hack of the front wheel This

break paint hack of the front wheel This

break paint hack to the truck of the surface of device just back of the front wheel This brush applies the paint to the surface of the highway, and a second brush at-tached a few inches back of the front brush spreads the paint to the proper width A red line is chalsed on the pavement aband of the patterneeder to guide the operator of the patterneeder to guide the operator of the patterneeder.



Three-wheeled hand-true pointing the truffe line conter of California

The Motor-Driven Commercial Vehicle

Conducted by MAJOR VICTOR W PAGE, M E. A. E.

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles

Rolling Palace Has the Comforts of Home

I you are noby, for highly percent a check running well into five figures a check running well into five figures you can now gratify every feelars for traveling luxury, distinction and acoveity you can be now to be a check the first and acovery modern motor box, an outlet has been given to the passion for a house on wheels or "letering couch" combining every modern convictnees with the ornibring every modern convictnees with the formation and the same and

and now with his citb car creation plans or renewing his acquantinace with America's wonders in a more leturely minimum and the planting of th



By living in this truck, the driver and his helper cover long distances with a

sleeping berths, shower baths, simple cooking facilities, cracked ice made as you ride, market news and entertainment by radio. The club car has all these conveniences and more Innovent looking papels of mahogany here and there conseal scores of unlooked for appointments.

pointments or palese is finished in unhousny and the finest of betthers throughout Entrance and exit may be made through five doors, three on the right side and two on the left. The made through a partition The forward part of the cur is equipped with four receiving chairs with adjustable lack is, head treats and arms which the receiving the curies with adjustable lack is, head treats and arms which the for two. The chairs are upholatered in taupe mohair plush with nickel fittings. Heavy adjustable curtains agenate the

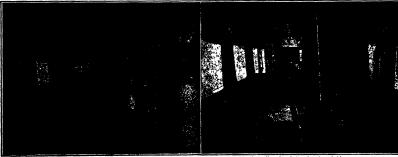
sleeping quartors from the rear compartment as well as the betthe The forward section may readily be transformed into a cosy dising room by the formed into a cosy dising room by the formation of the compartment of the when not in use, is concealed in a panti at the side of the ear. Ample light is provided by donue lamps and separate repul permits consumication with the driver without opening windows. The coah is designed for use in where as not be concerned by weather conditions. Ideal the concerned by weather conditions, losting fans keep the car cool in warm weather while beaters set flush with pipe of the engine keep the car warm of

the from and connected to the exhaust plue of the engine keep the car warm on the coldest day Further inspection of the rolling home discloses wardrobe and linen closets, oil and electric stoves, sink, faucets for hot and cold water, an lee making plant, its less refrigarator a china closet, a nickel hand basin, acclosed chemical tolkt, Franch mirrors and dust-proof servens of fine alcele mesh Several cold tolkthe control of the alcele mesh Several cold tolkthe cold of the cold of th

work and updaneery stem for the eather court is provided by a dispellent tank, pressure being maintained at all times taken to the product its provided by a dispellent tank, pressure being maintained at all times taken of on the transmission. An electric taken of on the transmission of the transmission of the taken t

Motors Are Helping the Rural Schools

THE HIT IS A THIND KNAD read by a leader of a reader than the reader that the



Two views of a inxurious motor home which contains every comfort found in the well-equipped American household

The Heavens in November, 1923

Figures Recently Arrived at Regarding the Great Nebulse

By Professor Henry Nerrus Russell, Ph. D.

HERE is no chapter of present-day astronlikets is no chapter or present-day astron-omy in which more rapid or remarkable progress is being made than in the study of the nebule. A few years ago, we knew little about them, except that they were hasy masses of light, for away among the stars, and that the luminous material was goseous in some cases, and not so in others. Now we think of them as grouped in three definite, though not quite exclusive, classes.

mutually exclusive, classes.
First in order we may mention the vast dark nebuls, which we detect only because they hide the parts of the Milky Way that he belind them. We over our knowledge with the belind them. We over our knowledge has been supported by the state of the stands of

in them produces most of the opacity by which we detect their presence. The nonrer ones are at moderate distances— a few hundred light years jet even so, they must be dozens of light years long they must be dozens of light years long These great clouds seem almost like resid-ual fragments of the primeval chaos. There is no reason why we need suppose that they have ever been other than they

Next come the luminous nebule in the year come the luminous nebules in the galactic region, including both the dif-fused and chaotic masses like the Great Nebula in Orion, and the rounded forms called "planetary nebulas." The beautiful work of Hubble has shown that these nebules are always associated with stars, and doubtless desired. nebulse are always associated with stars, and doubtless derive their light from the stars. In some cases the luminous region is clearly only that part of a greater dark nebula which lies near the star and reflects its light in others the luminous material constant of gas, which is set but how that happens we do not yet under stand, but it is very significant that the now max nappens we to not yet under stand, but it is very significant that the stars associated with gaseous nebulic are always of the very hottest types—most of all, those which form the nuclei of the planetary nebulso.

The Spiral Nebulm

But the most remarkable problem of all is set before us by those nebulæ which lie far outside the Milky Way, and form lie far outside the saltly way, and torin by far the majority. Hardly any of these show a guseous spectrum, and very few are chaotic in form Thousands of them are round or oval, brightening up gradually toward the middle. A smaller, though attll great, number show spiral arms extending

outwards from a central mass—evidently in one plane, for we have many cases in which they are seen edgefor we nave image of chansition appear to exist, from a round structureless mass, through more and more oval forms, to cases in which the spiral arms seem just to have budded out, those in which they are well developed, and others in which little of the central mass is left, while the arms have broken up into innumerable spots

box this obvious sequence give us a clue to the evo-lution of these strange objects, or are we merely reading into nature the plantastes of our own imaginations, so far-reaching a question cannot yet be answered fully, but there are many reasons to believe that the sequence

In the first place, these nebulæ are in rotation. For the brighter and inner portions, we know this with certainty from the spectroscopic work of several observers, following the brilliant initial work of Slipher The motion is in the direction which would carry particles at the rim of the nucleus outward into the spiral arms, and its rate may rise to a hundred miles per second,

Farther out, where the nebula becomes so faint that its spectrum cannot be photographed with any reason-able exposure, it is fortunately still possible to find the

motions of the individual nebulous condensations, by notions of the individual neodious condensations, by comparing the long-raphs taken at intervals of tes or a dosen years. Van Mannes, at Mount Wilson, has been the protagonist in this difficult field. Beven different spirals, which he has measured, all show motion of the nebular points around the nucleus and, though to a less nebular points around the nucleus and, though to a less degree, outward, so that they appear to be streaming away from it along the arms. The motions look slow (a few seconds of arc, at most, per century), but cor-respond to a complete rotation in from 80,000 to 200,000

years. This is a surprisingly short period, for the nebula are presumably very old, and yet the observed motions would carry their outer portions clear away, into the regions where we now mee nothing, in a single million of years. Evidently stuff is contain out of the nucleus and excaping into space—chining at first, then becoming dark. When one of these giant apprais is turned edgewise toward us, this outer region can be seen as a dark, opaque hand, creasing the brighter portions.

At 11 o'clock: Nov 7
At 10 % o clock: Nov 14.
At 10 o'clock: Nov 22.

NIGHT SKY: NOVEMBER AND DECEMBER

Distances and Velocities

In the last nebula which he has studied—known as Messier 83, from its number in the catalog of nebu necessor os, from its number in the catalog or necessary apprepared by that astronomer a century ago—van Mannen has measured four hundred of the almost countless specks of light in its outer portions. One of these showed a relatively rapid motion, and must be a falls star, Far nearre us than the achievals, all the others this ten; her nearer us than the arount, all the to be while in the property of the state of the state of the while in the state of the state of the state of the whilehool, spreading outwards. The labor of measur-ing, with all possible precision, so many object—not to mention the faths stars used as points of references— ment have been secremed. In fact, the writer may be such that stars used as points of references— ment have been secremed. In fact, the writer may be talking of the work. "Some time, after forty years or as, nonebody output to get new photographs, and near a thousand points on this nebels. Before that time I believe that the start of the start of the start of the start of DRI the results.

But the results richly justify the labor. Not only do But the results richty justify the labor. Not only so they give the nuset complete knowledge of nebular mo-tions which we have yet attained, but they make possi-ble, for the first time, a direct estimate of the distance of the object. One condensation, in the outer part of the nebula, is bright enough to permit a sportner determination of its radial wisocity; and it shows a

great difference from the velocity of the central mass, If we can safely pass from this motion in the line of sight to motion in the plane of the sebula itself, we may by comparison with the photographs work out the dis-lanca. To do this, we need only know at what engle the plane of the spiral arms is inclined to our line of eight? This is rather hard to find, but as the sheeter were very supported to the spiral arrays and the spiral arrays and the spiral arrays included to out these of spiral arrays are spiral arrays and the spiral arrays are spiral arrays arrays are spiral arrays are spiral arrays are spiral arrays are s

Per second that a this distance, corresponds to some of the control of the contro mate the mass of Messier SS, and it the motion of the outer part was orbital it would be easy. The period of rotation, at 10 minutes of ar from the nucleus, course out from was Manness significant at 170,000 and the contract of the contract of the contract nucleus should be about 120,000 times that between the earth and the sun. To keep a planet moving with this period at this distance, the mass of the nucleus would have to be 50,000,000 times that of

the sun! But fortunately, the motions of the various nebular particles do not follow the various nebular particles do not follow the ordinary law of orbital motion under gravitation. The orbital velocity, inatead of growing smaller at greater distances from the easter, gradually increases, while the outward motion diminiables. This while the outward motion diminishes. This is extremely pushing. The drep in the outward motion might be explained by the attraction of the nucleus, but the increase of the interest motion, at right angles to the radius, demands the action of a force which is neither attraction nor repulsion, but acts affecting the motion of the contraction of the contra

we were stewarys. No one has any idea with the second of t

The Heavens

By this season the winner consessioning are no our view. Octos is high in the stutiment with to our view. Octos is high in the stutiment with Manner are to be left, with a daring a kingel and account of the left, with a northwate said of an account of the left, which a northwate said of the left, which a northwate said of the left, the part of the left, which is the left, the said opposes in pice bearts, which is the left, the part of the northwate with Lyru and Again! putting high anorthwaters of it is dell; the panel seasily all behalf the only prominents weightingston without

The Planets.
Moreoury is in confinedict with the (Constance) on page (

Recently Patented Inventions

Brief Descriptions of Newly Invented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Acrenautics

Terraming to Aeronauces

ATEPILAINE.—JAJOOV, Paris, Ky This
havesties relates to controlling means for
provide means which may be smoothed in
the structure of an sirplane and which will
premit an exceedingly fixable control. It
is also as object to provide means whereby in
any be conferred, and means whereby to
facilitate the control of the sirplane when
facilitate the control of the sirplane when
facilitate the control of the sirplane when

in sight.

AERIAL PROPELLING MACHINE.

E. V Course, o'c Chilese Nevel Con., 66

E. V Course, o'c Chilese Nevel Con., 60

England. The sain object of this invention is to provide a permeable casing with descript wasse for endosing a rotary propinite control of the control of the provide case of the control of the propinity of the control of the propinity and control of the propinity assessment in the required direction of the propinity assessments in the required direction.

Pertaining to Apparel

Pertaining to Appared

GAMMENT POUNTST—G W WAKEN,

2007 Seminary Ave. Oakand, Colif. The
investion relates more particularly to a
proclimation of the seminary pounts of the seminary p

Arthogs, and removes the manufacture of the control of the control

2.-WHAT IS A PATENT?

PATENT is a seviey attainty results.

A right of property in an investion. In its insection the patent right was a managedy granted by the Crows. During the reign of James i the Raglish Parliament established the beginnings of patent rights as we knowled power of granting patents, accept in the case of investions. The patent today is property, it is a franchise; it is a contract with the Gerenmann, by virtue or which the huwston, is consideration of his giving the public hardwellers of which the huwston, is consideration of his giving the public hardwellers of the explication of which the discovery becomes public property, and, in so far at that pistent is concerned, may be freely made, used, and for practiced by prefection therein, both legally and equitably, as in the case of any other property, and have yill be calculated by a sasignann, divised himself of his property as is may see fit. A patent, contrary to a greated acceptance of the idea, grants the right to exclude others from so doing, if the owner of the patent so dealines. But the mere grant of a patent, even an entirely valid patent, does represent the right to exclude others from so doing, if the owner of the patent so dealines. Thus, the patenties may find himself the owner of a patent, and yet he may not be able to use the embet-matter of that patent without infringing the corresponding patent rights of another patents. On the other patented subject-matter of that later patent.

release and application.

Estimated Devices
THERMINAL FOR BRY BATTERIES.
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saw formed into shocks and deposited upon

dolpted table construction of a shocker that

may be readily adapted to harvester binders

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Of General Interest

Of General Interest
LIFE BOAT APPAIATUS — F A
GANARA, Harbor Spring, Mick. The
vention has reference more particularly to
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additioned air, the beat from compressing said
and does not require final, and which is
adjusted to actuate the propelled by onepressed air, the beat from compressing said
drinking purposes. An object is to provide
an apparatus which may be operated by the
companies of the beat for providing distilled
companies of the beat for providing distilled
to the propeller
COUPLING D. Zalzie, Gao E. Sint St.,
COUPLING D. Zalzie, Gao E. Sint St.,

ate the propeller COUPLING—J ZAITO, E20 E. 81st 8t., New York, N Y. The invention relates to a coupling particularly intended for converting the ends of a count or rope, or for other in the coupling of very simple form with a view to promoting convenience in applying the coupling to the verience in applying the coupling to differ a secure connection between the coupled elements. (See Fig. 1)

ments. (See Fig. 1)
WINDOW DOG KENNELL—C CRAD118, 2508 Medison Aver. New York, N. X.
118, 2508 Medison Aver. New York, N. X.

—A ArcoxA Magaliera, Mixto One of the principal objects is to provide a device which facilitates the ruling of lines with p.n and ink without solling or blotting the puper, and the blotting of the lines or writ-ing by rolling the blotter over the same thus the provided of the provided of the control of the lines of more, and the hotting of the lines or withing by rolling the hotter over the same thus pre-enting amening and further elliminating loss of time in picking up a separate hotter. The device consists of a plurality of sections, the outermost being adapted to be removed and discarded when unit for usa. (See Fig. 3.)

(See Fig. 3.)
COMHINGD PAIL AND STAND—A.
COMHINGD PAIL AND STAND—A.
Illustratorow, 415 Ann St., Birminghen,
Groun of labor where a poil is used it is
necessary for the worker to frequently stoop
for dipping the brush or the like. The object of the invention is to provide a conplet of the invention is no provide a
tone
to be quickly clear acid and a hold wherever the
user may wish, and thus climinate the tramost stooping. (See Fig. 4.)

some name time, eliminate the dis-persion of the control of the control of the FOOT RESP.—P P. Ir.r., address D. P. Rmith, attenny Corre, Par. The object of the invention is to provide a foot rest for the control of the tention of the control of the point of the control of t

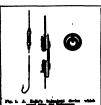






Fig. 3. The invention of A. Assens furth-

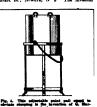




Fig 5 To provent evaporation, this tank, invented by A. S. Cooper, is subserged in



Fig. 6. Motoriots will approclate this simple pertable medicale bridge, the idea of R. D.



has been granted two patents of a similar which may be easily attached to the ordinary nature relating to wastly coses adapted to window serves without the use of salts or contain a certifical with compact power, green. A further object is to present the control of the certification of the certificatio

wants can be rastened and unfastened with out any effort and still positively socure the cable to the object so firmly that it cannot less its grip, no matter how much towing power is applied.

cable to the object sor strang, onc. a vaccination of the control of the control

ing mean.

CLOSHES FOR CONTAINERS.—D

RECON, 1558 Edith St., Serkeley, Calif. The

Pentary object of the invention is to provide

preserve glasses and tumblers, and which

may be produced at a molest cost. A fur
ther object of the invention resides in the

cashes the contract of the invention resides in the

cashes the closure to be used by looue
wives as well as packers operating on a

large scale.

SCRFENED DRAIN—T C. KUNKER, Madrid, Neb. An object of this invention is to provide a screened drain which is adapted to be used on a window or door screen and

the fame.

MATCH CASE.—S Brazoux, Bor 461,
Times Plaza, New York, N Y Among the
objects of this Invention is to provide a case
objects of this Invention is to provide a case
thereof and delivering the natches singly
whereby the case may be employed as a
bolier for the lighted match to precise the
improved for jecting the used match, the
device may be used in connection with common form, or setty matches.

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A W H.

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out of order

FACING FOR CEMENT WALLS.—F

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that the facing may be adapted to be locked
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DIVISION PLATE FOR EGG CASES.

—J C. Voorgonst, 436 Star Bldg, Wash-

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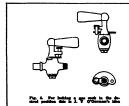
Hardware and Tools

CRATTERING AND CLAMPING MEANS FOR BAWS AND OPERE ARTICLESS.

OL Noman, 224 W 20 db; Wilmington, Del. The invention relates to arber for large from the control of the contr

lington, D C The invention aims to provide for the facility with which the vide a dones peciting division plate opacity and we or like may be damped or released. On the line with the control of the line with line sew on this may be changed or released. ST PR BENJAM CLAMP — W EAST, STS 85A Ave, New York, N Y, Among the children of the chi

sirals incident to use. (See Fig. 9)
ADJUSTARIDE BRACEs.—W. Lancesum,
Eur 605, Colsen, Galit. This invention inliant to brosse used for impacting return
and enhern, the particular object being upprovide a bress that may be used in the
ordinary vary but possesses special festions
or disputability and can be used in discover
the ordinary bress would be presticully used.
It is a further object to produce the
bress without nutriality increasing the cost
of seminations. (See Fig. 3.5)









State of Particular



Fig. 12. Breaking of electric light filaments in less anneying, following the invention of this device by A. R. Valaisan





Fig 14. In this machine H. War-

Beeting and Liphting

LAMP PINCHAID? AND RIPPORT.—
A S. YOUTAM, 120 W Weshington St.,
Greswills, S. C. An object of the invention to to provide a flament and separated
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FURBACE GRATE.—II. BERTOR, 607 to atomise the oil or beary hydrocarbon, particularly related controlled to the invention is to provide a substantial designed to be unployed controlled to the invention in the provide of the invention is to provide a substantial designed to be unployed controlled to the invention in to provide a substantial designed to be unployed controlled to the invention in the provide of the provide and substantial designed to be unployed controlled to the invention in the provide and substantial designed to be unployed controlled to the invention in the provide and substantial designed to be unployed controlled to the invention in the provide and substantial designed to be unployed controlled to the provide and provide the provide and substantial designed to be unployed controlled to the provide and substantial designed to be unployed controlled to the provide and the provides and the provides of normal to the provides and the provides of normal to the provides of the provides of normal to the provides of the provides of normal to the provides and provides of the p

varjing diameter of the warp beam.
FILM CLEANING APPARATUS.— M
COREM, c/o I Pulver, 1016 Longwood Ave,
Broux, N Y The invention relates particularly to an apparatus for cleaning moving
pleture films. The object is to provide as
apparatus which will clean both sides of the
film without in any very injoiring the same,
the derive greatly washing the sensitized side
and the contraction of the

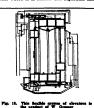
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the facible type. The primary object is to provide a coupling for magnetos, generators and other accessories used in connection with internal combustion motor power plants. It is a further object to construct a coupling by means of which the armature shaft of the magnets is adjustable relatively to the diving shaft to permit of a proper timing of the magnets.

Railways and Their Accessories

door when moved to closed position can be very easily looked. The fasteser is simple and strong, and requires a minimum of parts all of which are easily accessible.

Pertaining to Recreation

Pertaining to Recreation
PAYEMENT GLIDE.—W. O. CAMERY,
833 IN 8th 8th, Walls Walls, Wash. The
instruction relates to roller skate or persented
formation relates to roller skate or persented
form, and will tendency decrease relation, that
will allow the wheels to be of larger diameter with a resultant higher degree of skaliftens with a resultant higher degree of skalifing down bill, and at the same time largely
eliminate the danger of falling backward.
[Ree Pig 22].

rection of the vehicle is performed, the de-vice also indicates the intention of the driver to stop. The signal may be used by night or day

ice one. The signal may be used by right of APPAPP 'NOR 'HEMICANS.-! B. HARDON, d. A. Object of the invention is provide a support or crashe adaptation in the support of the support of crashe adaptation in the support of crashe adaptation in that the our may be adversaled in the province of the crashe in the our may be adversaled in the province in the crash in provide and the province in the companion of the validate from insects, substantially successful or a validate in provide the companion of the validate from insects, such cases of the province in the validate (See Fig. 25). the purpose of making ant texture facing difful space and the property of the control of the property of the control of the property of the pr





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Chemical Processes

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PRECIMATIO SUPPORT—G. JORNARY,
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latter is likewise pivoted to the seat propent the beding of the branch to the best effected with a fink as a safety catch for a door the branch to the best effected when glar Another object is to provide a branch of the provide and winding a structure with a locality but and a first provide a branch of the provide and winding internal theorem. The BRIGN.—J. G. WILLIAMS, I.G. E. 47th.

TERR BRIGN.—J. G. WILLIAMS, I.G. E. 47th.

E. M. W. Y. K. N. T. The object of the latter of the provide and the provide a

shape. RECEPTACLE—I LEVY, e/o Med-themen & L. v. 202 Jan St. Broodlyn, N Experiment of the provide a decident of the provide a device especially adapted for con-taining cakes and similar perishable foods, the duvice being constructed with aliding doors giving access to the compartment in The device is simple of construction, and casy of operation, and can be manufactured at a reasonably low price.

Machines and Mechanical Devices

Machine and Mechanical Devices
INK DISTRIBUTIOR—D V KAUFMAN,
2 W 1170 BE, New York, N Y An obbect
for printing pressue which may be boilty
applied and removed without injuring the
for printing pressue which may be boilty
applied and removed without injuring the
to growtine an inti distribution prontruction
whereby all parts of a sheet may be applied
to growtine and other representations requiring an appreciable amount of ink to all
MOLDINIO MACHINES. P Dim. 46
MOLDINIO MACHINES. P Dim. 64

MOLDING MACHINE. - P DHE, 49

ADDITION THE THE CHIPM. — P. DINE, 40 EN STOTE DATE OF THE CHIPM. — P. DINE, 40 EN STOTE DATE OF THE INTERNATION OF THE INTERNA

thanously inwardly and downwardly PUMP - M. P. Proxars, 357 Hamilton Ave, Brooklyn, N. Y. The general object is to provide a pump for pumping viscous substances whereby the flow of the material will be facilitated. A further object is to provide a steam jacketed jump cylinder for the heating of the viscous material and to utilize the steam as a motive fluid for turning the num.

DOUGHNUT MACHINE -C A PURST. DOUGHNUT MACTHINE—C A PURST, 825 Wayns Ave, Chicago, Ill. This inven-tion has for its object the prevision of a device in which the amount of dough forced through the cutting dis may be varied to produce this or thick doughnut. A further-object is to provide a machine in which the dough is first drawn into the device and then forced through the dis.

dough is first Graven into the device and then forced through the dis.

METERION AND APPARATUS POINT APPARATUS

speed, at the same time deliver a sarge volume of liquid ROAD MACHINE.—K. Christermore, Beneditch N D Among the objects of the Beneditch N D Among the objects of the adapted to cerry out road building or repairing oparations, which is effective in opportance of the certain constitution the roadways, which is facilitied in the action, easily controlled and of simple and disruble construction.

GLASS WASHING MACHINE—P

RUBREAM, 49 Burnham Bonh Straw Mg

Co. Nevrice Centre, Mean The Invention address to dis casting the strain of the Straw Mg

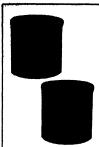
Mich is especially designed for heading reasons are strained as the strained and the strained

contained and thereaghly citedent, and can be be controlled by a power without howfueles of controlled by a power without howfueles of mechanical derivation.

BACLE ATTACHEMENT—F. R. WARD.

BECALE ATTACHEMENT—F. R. WARD.

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How much more is the lower one worth?

facture of the lower jar has done away with the specks, blisters and blow-holes found in the upper one It is worth much more to dealer and user as a result, to dealer and user as a result, and the cost of removing the iron during manufacture with Dings "High Intensity" Magnetic Sep-arators is negligible.

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Dings Magnetic Separator Co.



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The Animal Hospital

The Annual Heaptum
(Continued from page 218)
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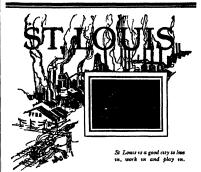


an accurate estimate of the number of parti-cies is a cubic lack of essent. However, the control of the control of the cubic with the first numbers, and the control of the cubic with the numbers of the cubic state of the cubic \$4,000,000 cement: particles could be placed in a single layer on a piece of gisen one inch square. In a cubic inch, then, there would be approximately 1,600,000,000 or would be approximately 1,600,000,000 or these particles, instead of only 46,000,000 or ne that would occupy that space if all the solution of the cubic state of the cubic state of the solution of the cubic state of the cubic state of the solution of the cubic state of the cubic state of the solution of the cubic state of the cubic state of the solution of the cubic state of the cubic state of the solution of the cubic state of the cubic state of the solution of the cubic state of the cubic state of the cubic state of the solution of the cubic state of the cubic state of the cubic state of the solution of the cubic state of the cubic state of the cubic state of the solution of the cubic state of the cubic state of the cubic state of the state of the cubic state of t

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either—The Industrial Diport, 3 rft, pp. 18764. A New Fätzusie Principle has been written by an English eisenfat, Dr. Hein-hew who conseived the idea of Streaten brought his edges of a large number of about people file being as antirely different encogion to the umai case of illustrian knowled the surface of a sheet. Both sheet of the waterproof pages in perfected with the facilitate market of holes froming relate and leasted a results of the best being the contract of the contract of the the statement of the best forming relate to the contract of the contract of the the contract of the contract of the the contract of contract

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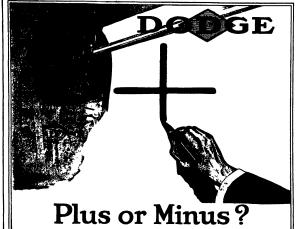
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WHICH is true in your factory? That long line of shafts and countershafts equipped with hangers, pulleys, clutches and other power transmitting units, is either delivering the maximum of generated power to your machines or robing your production of, an absolute essential to profits.

Many executives, department heads, superintendents or foremen, point with just pride to a model power plant, efficient boilers and a dependable fuel supply on the one hand, and to the latest in productive machinery on the other, give slight heed to the link between these two elements—machinery for the transmitting of power.

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Stop the Power Thief!

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But the link between boiler room and production and was in many tases lightly passed over. The emutative expansed an opinion favorable to group drive and know to assets. But when it came to the elements

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"We see going to sell power transmitting

mechinery on the balance aboot basis," was the decision of the Dodge Mannifecturing Corporation. "We are going to prove the existence of a power third all along the line between boiler room and machines. We must show the suscentive that these rod figures in regard to delivered power on the mouthly report can be exidented and that Dodge Transmitting Units mean power.

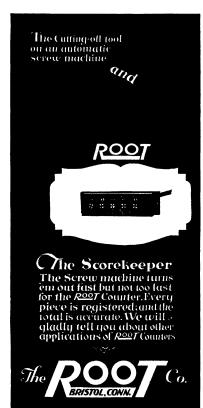
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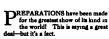
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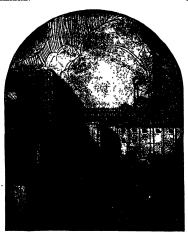
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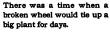




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NOVEMBER 1923

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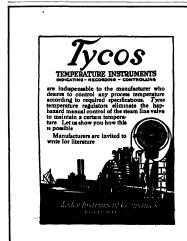
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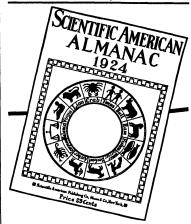
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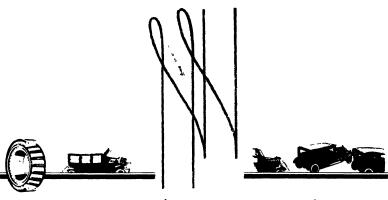
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With the Editors

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T is surprising how much controversy exists in this world of ours. No one realises this condition of affairs more than the technical journalist, who is constantly sial matters. And if the technical journal sial matters. And if the technical journal is it wishes to be unbiased and fair to every one, he finds plenty of additional work to toesp himself occupied. If he prepares an elaborate article on some new invention, he is immediately confronted by the statements and arguments of those whose business is bound to suffer from the introductions of the statements and arguments of those whose business is bound to suffer from the introducness is bound to suffer from the introduc-tion of this new invention. Indeed, to please everyons concerned, it would be nec-essary to publish two separate accounts of every technical advance—one dealing with what the advocates would like to read and the other with what the antag-centra would like to read. Perhaps it would be better even to publish two sep-vents activities one for the advocates and would be better even to publish two sep-arate editions, one for the advocates, and the other for the antaganists. A further improvement on existing methods of pub-lishing would be to send a plain edition, containing nothing but blank pages for the subject in question, to the average, dis-interested reader, so that he might not be led agreey on way or another! led astray one way or another!

BUT then there are times when the tech nical journalist is really at fault Despite the utmost cure in guthering facts and in weaving them into an interesting yet disinterested account, misstatements of yet disinteresce account, missiatements of fact will sometimes creep into our col-umns. The editorial mind is always keen and alert for possible misstatements in articles contributed by outside writers, in articles contributed by outside writers, in truth, writers are relief upon for accurate facts only after they have established a reputation for accuracy, and they are im-neediately cast into disfavor when they are found to be inaccurate. The Schwarze Amstran has long prided itself on its edi-torial accuracy. But for all that, mistorial accuracy But for all that, mis-When they do, they are soon called to our attention by our very observing and well posted readers. And in a spirit of fair play, as well as a desire to give the au theatic information, we are always ready to acknowledge and correct such unistakes.

OUR Abrams investigation and our pay-OUR Abrams investigation and our par-chic investigation are in full wrinz in this issue will be from the results of writing medium, together with the report of our committee, as well as the comments and suggestions regarding our first elec-tronic results of the report delicity with the report of the delicity with a shiplect that crossed such in-tequet as the Abrams investigation. Lef-ters are coming in from all parts of the capatity. We die bearing from orthogo-diouts, who is some inference condenses

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The state of the s

travagant claims of electronic technique, and in yet others compliment us for our initiative. Then there are letters from electronic practitioners, who are equally complimentary and anxious that we examine the matter than the contract that the examines the matter than the contract that the examines ine the matter thoroughly, so that their remarkable claims may be substantiated. remarkable claims may be substantiated. This investigation, according to present aigns, is not going to be an easy one. It is going to take time it will require much patience A plan of campaign has been laid out which takes into consideration the catalylahar of the more demarkable or the consideration. the establishing of the more elementary facts before proceeding to the more in volved, and, at intervals, certain check backs to verify our sum total of findings.

us for devoting any attention to the ex-

I wan investigation such as ours we must work entirely with first-hand informaa work entirely with first-hand informa-tion. We welcome letters giving experi-ences with the electronic diagnosis and treatment, we welcome reports from doc-tors and electrical research workers and others who have conducted tests of their own with the technique and the apparatus own with the fecinique and the apparatus involved, we welcome suggestions from Dr Abrams and his vast number of stu-dents and workers. Already we have a vast amount of such material on hand. Still, in the final analysis, it will be the facts which we obtain ourselves from face to-face contact with the entire subject

OUR next issue, carrying the January date is to be largely devoted to the automotive industry. It comes at that time of the year when virtually all the automobile nummfacturers have annoneed their new offerings of the senson, and when the average man is giving some thought to his next car. Perhaps its most destinate of the property thought to his next car Perhaps its most significant feature will be the price chart, which will give at a glance the story of each type of automobile and motor truck then on the market This chart, representing a compilation of a large volume of data gathered from the makers, will give the number of cylinders, the horsepower, wheel base, tire size, and price Thus the reader will have before him in tabloid form the entire story of the current automotive industry, and, with a given amount of money to spend on a car he will be in a position to invest

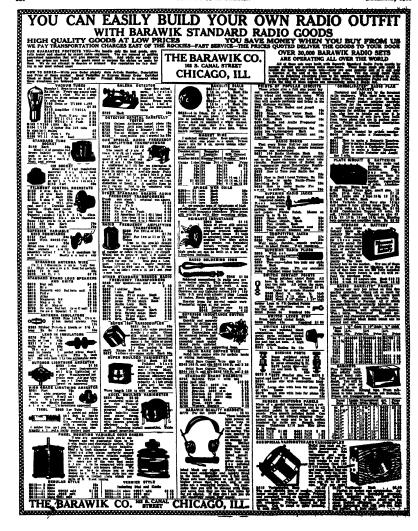
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THE new four wheel brakes and the "bulloon" tirs will be discussed, along with the several innovations in engine design automatic gear shifting etc. The problem of promer bulkeriton bulkeriton. problem of proper lubrication both for the special consideration, for it is a proved fact that repair bills are largely based on insufficient lubrication

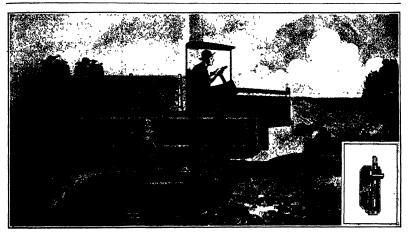
THEN there is that major problem of motordom — the highway problem What with hundreds of thousands of new cars being introduced each year, in addi-tion to millions of old cars which are still a long ways from the scrap beap, the highway situation is becoming serious, Our motor laws are fast becoming hopelessly obsolete The inter-state tourist has brought about an urgent demand for the standardization of laws throughout this broad land of ours Accidents due to careless driving, headlight glare and other causes complicate automobile legislation still further All of which comes in for due consideration in our January issue, which will be the opening gun of our campaign to solve the highway problem



SEVENTY-NINTH YEAR

THE MONTHLY JOURNAL OF PRACTICAL INFORMATION

NEW YORK, DECEMBER, 1923



new parties of the pa

here. be main difficulty met with in connection with any force attempt to solve the problem was that the pair results as a proper in the problem of the prob

A Wheelless Motor-Car By Dr Alfred Gradenwuz

forward past the underframe at a more rapid rate than that at which the inter will presently glide across the manner of the property of the pr on the road. The venters, as it were, turows a organization across ditches, which accordingly are traversed with greatest case, it will readily negatiate even conditions for gradests. Banaunch as the weight of the engine is of no importance, crude oil engines can largely be used driving this type of which; thus reducing considerably the working expenses. Entire irains can be formed such while/so, though only the front which need to power-driven

power-driven
The whick is without any exertion and without the
aid of any complicated mechanism steered from the
driver's gest by means of a hand-wheel altering at will
the angle between the two sets of runners. Any curve
cut time to readily described, the relicite being even
turned on the spat, without any forward or backward
motion. The sept of the or is notice ways sirved at will
between the normal signs of 1.50 meter and zero, thus
making heavy gradients to be readily aspectated.

While the cost of construction of the vehicle is only immaterially in excess of that of ordinary tracks, the wear and tear are reduced to a minimum, there being no friction or stipping on the ground. The vehicle will be found especially useful on impracticable ground, on soil to be brought under cuttivation.

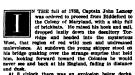
Charles Proteus Steinmetz

JUST as we are going to press, and too late either for preparation of an extended obituary or for the accommodation of such a notice in our pages already made up, comes the news of the death of America's best known engineer Dr Steinmeiz was born in Germany in 1965, and received a good education—His Socialist proclidities forced him to see the country—and he came to the United States, without funds and with alight knowledge of our language, in 1880 He secured work as a draftsman under an environment that gave ample as a draffman inder an environment that gave ample scope for his natural designin, and eagineering ability, and his rise to the top of the electrical engineering profession was rapid. He was came into the employ of the General Electric Co., and for many years prior to his death his name was synonymous with the extra ordinary development of organized research and the magnificent laboratory maintained by that company at 8thene tady Among his peers, he was recognized as the foremost exponent of the union of mathematics and electricity He was responsible for the modern mathe matical treatment of all alternating current problems and Edison characterizes him as the world's greatest practical mathematician. To the general public he was probably best known for his high voltage experiments.

With Fire and Fraud

Something About the Acquisitive Gentleman Who Burns Buildings for Profit

By Edward H. Smith



and dusk.

At 8 o'clock there was an explosion below decks.

The upper parts of the vessel fired like straw Below decks the incorrable sen flowed in, through a great gush the powder had opened in her belly. The cargo of bricks hore her swiftly down. No pumps might hope

of bricks hore her swiftly down. No pumps night hope to keep such a swreck about till allow got the boat after some agenite. Guytain Lancev got the boat after some agenite. Guytain Lancev growther to England the follow hig day and Lancey reported to his brother-heiw and employer, one lionen, then sitting in Parliament for Birnestaphe Boson sent his captain to a proctor, before whom the mariner serve that the firing had been acceleration and that nothing could have

Bring has been accurated and that setting consumers walled to save the ship or her cargo Bensom left Ragiand for a tour—and Lancey stayed behind. A little later, through the tuttle of some left tongue, the captain and his rich relative became suspect and investigation showed that Benson had laden his ship with a cargo of merchandise for America, insured the vessel and her contents for twice the honest value and vessed and her contents for twice the honest value and later secretly had the goods removed and the ship filled with bricks for ballast. He commanded Cuptain Lancer to take her out to see and set her after. The young man declined until his relative pointed out to young man declined until his relative pointed out to bim that it was within the latters power to discharge and beggar the semman. Then Lancey complied, setting fre to his own ship under his feet by means of an ex-plosive mechanism which rapidly spread the fire

A few sentences from that treasure house of bit-rest recollections, Camden Pelham's "New Newgate terest recollections, Camden Pelham's "New Newgate Calendar," will complete this tale of early commercial

"His employer fied . and his unhappy dupe-ing brought to trial, was capitally convicted and re-

"This employee" to real id. employee and not assimably only extended sentence of death. He subsequently lay in prison for about four months, during which time he pursued for about four months, during which time he pursued his devotional exercises with the utmost evenlarity, and was hanged on the 7th June, 1754. at Execution Deck, in the 27th year of his gas manufactory destination it is surely not to hold poor John Lancey in a pittons extension of impure memory or to express his name to further obloquy, for he was, as the Newgart Oxiendar streams of the private memory of the properties of the proper provided similar protection much earlier, and, more than likely, Shakespeare's Antonio came into dour Shy lock s grip through the need of a premium for marine insurance—to cover those delayed "argosies in Tripolis,

insurance—to cover mose delayed "argones in Tripons, India and Werkor" So, Lancy is but a reminder. In beginning to write of fire as a criminal instrument, some invales and strangenesses are to be noted. Fire, the one pure element of the ancients, employed for foul importities, fire, the source of light, in the service of impurities, inc, to source or light, in the service or the forces of darkness, fire, the great reagent of the alchemists, by which man was to gain the secret of high fortune and lasting life, used to spread misery and death, the deep-searching finne of Hermsn Tris-megistus, Zesimus of Panopolis and Paracelaus Hohen-helm in the hands of Benny the-Bake and the Freebag

oric conflict between man and his P friend and Satanic enemy becan in the hone-street grothes where the dawn man gnawed the joints of his roasted prey, or in the vanished forests that burned and cussumed wandering tribes of hunters in ages forgotten and lost It continues in the age of concrete and stee

To guard against this foe-friend, men have made ton thousand experiments and inventions, meantine extensions of the second of th



Firemen working on an incendiary fire in a city

about the installation of subscioe curtains in thesiters and the general adoption of frasproof construction. Since that day many other installations have been insude-ull sited rulicoud coaches and skeeping care, great builded and the state of the state

difficult to say. Authorities disagree and focusion. All definition is also definitely in that is remembers strength in in program in this country between destructive far and the agencies of defenses and prosecvation. Fire in-surance companies here naturally taken a leading part in this effort to reduce the five loss. Their strength has been expended making in combatting the accidental five, the truit of carriements, fregratuleness and stugdity in

But there is a far desper and darker strugge that the But there is a far desper and darker strugge that the structure of the

The story of the fire-setter is of itself an old and stale one. Purposeful fires among merchants became a common jest before the birth of any man now living. common jest betwee the birth of any mean now living, we all now how old and simple a thing it is to heave with a simple of the common of the c vestigations are now reasonably rigid, whereas they were once pitifully lax. The action of creditors is, in this day, remarkably swift and consecutive. It used to be slow and easily exhausted In brief, the firebugs are now being resisted and punished. The result of are now being resisted and punished. The result of such action has not been to drive them out of business, but to sharpes their wits and attinuisto their haventive that the sharpes their wits and stimulate their haventive This is the chief procecuration of a large snal gowting class of criminals against whom no resulty affective measures have yet been developed. The rationale of commercial cross needs to be under-tended It has often been said that string selcons figures

stood. It has often been said that firing seldom figures in fake bahruppet cause. The truth is otherwise. If a crooked merchant wants to go fraudgliestly broke and hus cheat his rectitions, he must get rid of his goods somehow. To remove and hide them, thereafter claims always made. Many crooked perchants consider it as clewage technique to burn out their nearly empty gross after the valuable part of the stock has been secreted in that case the creditors select his language made. Not what matter to the thief! He has his goods, but what matter to the thief? He has his goods, but when taster to the thief? He has his goods the stock of the stock of the secretic selection of the stock of the secretic selection of the stock of the secretic selection. The secretic selection is a shifted from the shoulders that the secretic selection of the secr

insured third Moreover, there is always the older de-what's coming to them and the burnet-out merchant what's coming to them and the burnet-out merchant inkers the behance, plus the hidden merchantles. In sull other cases, no creditors agree, The aresonist has relied to the contract of the contract of the burnet-out his shell of a store. In every case where stress is committed the problem of antity for the criminal plays a leading part. How desired the contract of the committee of the problem of antity and the contract of the contract of a fire when the persons interested in the insurances are demonstra-tion which attended in the insurances are demonstra-tions which attended in the insurance are the qua-tions which attended in the insurance are the qua-tions which attended in the insurance are the qua-tions which attended in the insurance and the con-tines in the heart of this article time in the heart of this article continues attendiny to a seen and ordered in that most entimest authority on around and centerful to that most entimest authority on around and with the probability of the contract of the contract of the con-traction of Coroll Mass. It were the probability of the pro-page of the contract of the con-page of the con-traction of the coroll Mass. It was the con-traction of the course of the world.

and accordingly occupies a special position in the world

and accordingly occupies a special position in the world or trime supposed on.

One of the recent of the recent of the recent is from the recent of the rece

outer edge of the sensor had been tacked twelve or fitness little spright places, the top of each supporting a small bladder or very thin rubber. Each of these little bladders was filled with five or six ounces of geneline and tied shat securely Similar fire machines have been found in which one or two cow's bladders had been much each laden with three to four quarts of

had been smooth on the factor of two over a insiders and the popular moder and the popular moder field.

The theory of this mechanism is simple enough. The condits in the center had been cut to a length which would been for nine of ten hours before reaching the could be made a line or ten hours before reaching the coldes, when the proprieter of the shop had clessed his door and gene home for the night. It would do it to deadly work between three and four o'clock in the morning. As more as the candle burned itself since the state of a score of pieces at once and the explosion would surely discorn all westing of the mechanism. To make sure of the work's success, the floor had been soaked with gazantees at success, the floor had been soaked with gazantees at success the points and the part of the store nearest with kimonos, kee curtains and other highly inflammable materials. In this single case the firchely failed in how many others of the sort did he succeed! In one of the upstate cities of New

In one of the upstate cities or new fork, not long ago, an Italian grocer and general merchant occupied the ground floor of a frame building. An outside stairway ran to the second floor, where a Byrian artist lived with his wife and children. In the basement of the premises was an old fashloned hot-air furnace, the pipes from which ran to registers in both

A little after eleven o'clock, A little after eleven o'clock, on a cold night last winter, the wife of the Byrian living in the upper story awoke from sound sleep and amelied a strong oder of gasoline. She hesitated for a few minutes, but as the odor grew in heaviness, she threw on her clothes and started for her husband who were at a below practive from hand who was at a lodge meeting two or three squares away. Just as she opened the door he came in and reopened the goor ne came it and re-coiled from the gas. He went down-stairs immediately and, not without some suspicion, forced his way into the Italian's grocery store. Just as some suspicion, forced his way into the Italian's grocery store Just as he did so, he saw a shadowy figure retreat to the alley and drive off in a motor car, which had been standing close by with lamps out

continued to the part of the part of the color by with lamps out Inside the store the Sy fan found a designation of the part o

Undoubtedly, had the Syrian and his family been in temporaredy, not the bytes and the first same, they would have been blown to kingdom come. The Italian had expected the furnace in the basement to cause the confingnation, as soon as exough of the gasoline from

the water cooler had dripped through the floor and formed a gas. Not, to make doubly sure, he had seat had brother to throw some bit of horning stiff into the store. This was the man who had been seen silating of the history car in the silating. The plotters were detailed in the core car in the silay. The plotters were detailed in the core and the silating of the history of the plotters were detailed to the silating of the sil the professors of armon

the professors of areas. One method of the Message and the Mes within reach

within reaca.

Such spontaneous combustion barrels are often employed by dry goods and clothing merchants. The burrel is prepared with its spants and put into the rear of the store, where windows are kept open to carry off the



The interior of a store after a configuration of enunicious origin

oder of the mutter. The needed know, of cutter, how how man hours must glasse before the distinsi-nious how man between the dispose before the distinsi-tion of the control of the control of the control is also at dust on Saturday and gow about list pleasure lie has not, of course, forporten the spiralite a good but of gasoline about now the semueldering hurre! Netther has be neglected to hang up costs, dresses, curtains, wrappers and all sorts of loose combinabilities where the first flamou will reach them

first fames will reach them
Thirty-odd hours afterward, the saudge in the barrel
breaks into brilliant flame. The fire apreads quickly
to the gasoline-impregnated wood and the fire-hungrhungings. The store is guitted in a few minutes. Before the fire machines can arrive from any distance, the whole place is an oven and when the water from the hose finally gaine custred of the first the interior of the place has been so completely burned out that it is in the place had been removed in a drunce. In case the first is found and got under hund before it has a chance to fare up well, the origin of the blaze must be found in a harrel of waste and only the expert will suspect that this spontaneous thing was a work of art

that this spontaneous thing was a work or art But the individual fire setter is no longer so great a measce as once he was. The big and successful was of commercial arson are managed in these thuses by organized gaings or areas rings, as they are called organized gaings or areas rings, as they are caused Such cliques of fire apeculaists now operate in all parts of the country and a number of them including all the members, have been sent to prison through the work of Mr. West and others

The armon ring consists of the fire insurance agent

the insurance inspector, the crooked merchant, the expert fre-setter and the insurance adjuster. The merchant is appeared to the control of t the insurance inspector, the crook

and pre-klou are the virtues of this pian of action. It is applied to man other types of lanarance modern the property of the torship.

A few years ago a boardwalk shoe dealer in Atlantic City vanished with dealer in Atlantic City vanished with a large stock of costly merchandise. Mr West, sent to find the absconder and his wars, found among the few papers left behind by the vanisher, a bill for a dozen animal sacticals. He could not imagine what a smart shoe shop night want with animal satches until be discovered that they had among advisors for the dozen. been reshipped to the address man of the same name as that borne man of the same name as that borns by the slow merchant, in a small Pennsylvania town. The investigator horried thirther and found that the interest of the man and the slow merchant let us call him Schwartz, since that was not his name. The eider Schwartz had been a merchant, had suffered several fires, all of them diesafrons to the insurance companies and had finally re-tired. His son had then entered the marcantile field, with results already

antmal trainer His past disputed this. The shipment of animal sutchels confirmed it Mystery! A little more watching and questioning decided the investigator on his watching and questioning decided the Investigator on his course. He were law for a time, only to respons in the garb and personation of a circus man. In this char-ter control of the control of the control of the con-ception of the control of the control of the con-trol of the control of the control of the con-trol of the control of the control of the con-trol of the control of the control of the con-trol of the control of the theory of the control of the contro arched her back hall), lifted a paw and pulled the short chain of the gas tap lighting the mantle from a small

chain of the gas tap lighting the mustle from a small pilot I suppose every reader with anch gas lighting apparatus. West needed to know no more. He understood that old Schwartz was training cats for arreas. A merchant of the control of the control of the control of the same and the control of the control of the control of the same pilot, which burned day and night, set off an ordinary gas ity. The cut had her table, but under this device and amused berself to plaving with the chain, turning the fame up and down as old Schwartz had tought her Tore came the night of disaster. The large control of the control of the control of the control of the pure pulled the chain a great dame symmetry in lestifier. pussy pulled the chain a great flame sprang up igniting mables which laid been arranged above it and

(Continued on page 197)

The Fuel of the Future

The Advantages of the Universal Burning of Gas, and the Obstacles in the Way of Its Attainment By Ismar Gusberg



HEN the pulselithic Man discovered fire and learned that the earth about him abounded isarped that the carri about him abounded with matter that could be burned and in burning could furnish him with heat not only for boilily comfort in the cold of the winter but also for fashioning tools and weapons and for cooking his food, fuel first assumed

its position of transcendent imporin human affairs. This tion has gradually developed into one of even greater significance as society grow more complex and the arts and sciences of civilization were evolved until today fuel is undoubtedly the most important single commodity employed by the human race in their home and in-dustrial life. Fuel is the size quason of modern civilization With the comforts and luxuries of industrial enterorise would be practically nil-in

fact, society, as it is consti-tuted today, could scarcely exist. It is therefore not at all strange, when disruptive forces, such as strikes, make

their appearance in the news of the day, that each and every member of society should become greatly con-cerned over the matter and be apt to view them as blows directed against the very foundation of the structure of modern life A greater calamity cannot be imagined than the sudden shutting

off of our supplies of fuel

A fuel is a substance in which there
is concentrated great heating power This power or energy is released when the fuel is brought to the proper tem-perature and burned. It is well known that all fuels do not burn with the same degree of readiness. Thus, while a piece of paper can be ignited by the ut of a burning match and simi the stream of gus issuing forth fro

the gas burner, nevertheless wood must first be heated upon a paper fire before it will itself catch fire and burn On the other hand, coal is still more difficult to arn, and a wood fire must first be built under the coal so as to bring it to the burning temperature before it will ignite. It is also known that the different vari-eties of coal burn with different degrees of ones soft coal burning more easily than hard coal. All burning is simply a rapid union of the carbon and the hydrogen simply a rapid union of the carbon and the hydrogen and the various other elements, as the exist in the combustible, with the oxygen of the atmosphere. The products of ordinary combustion are water vapor and carbon dioxide, when the combustion is complete with

carbon dioxide, when the combustion is complete with more or less carbon monoxide in place of some of the dioxide, when it is incomplete Coal is the product of the partial oxidation of vege-table matter under great pressure and in the absence of table matter under great pressure and in the absence of sufficient at no cause its complete destruction—a process extending over a period of a million years or more. According to the duration of this process, various kinds of coal were evolved. Thus the oldest form of coal is cultied antiractic, a product in which there is presclically no robotile matter, atmost all the combastle be matter being in the form of a hard, compact mass. fixed carbon. Anthracite is sometimes called stone coal nxed curron Antiracite is sometimes called stone coal because of lis hardness and difficulty of ignition it is the coal that gives very little or practically no smoke on burning That is why it is used in domestic fur-naces in cities for heating purposes and in making

hot water
As the age of the coal decreases, it becomes softer
and richer in volatile constituents which produce smoke
when it is barned. There are various intermediate
grades. There is a senii antiructic coal, found in conparatively large amounts in this country, and almost as
useful for domestic use as antiructic. Then there are
the semi distuntions coals, the Mitunianous and the subbituminous coals. The bituminous class is the most im-portant of all for these are the coals of industry. The coal that is used for gas making (gas or coking coal) belongs to this class. A still younger coal is lightly, or brown coal. It is a substance that has not been sub-jected to so complete a decomposition as real coal, and hence it down not possess the heating value of the latter Finisity, there are the pest coals, which contain very high percentages of modistrue, and which are not of any great technical or industrial importance. From a stand-

point of usage they were probably the first coals used, as they are found so close to the surface that no extensive mining operations are required to render them available.

required to reader them available.
Coal is found everywhere. The
United States contains year deposits. Anthractic coal is unhed
mostly in Pecasylvania and West
Virginia Bituminous coals are
found mostly in the Appalachian
region, which is the greatest store-

region, which is the greatest store-house of high grade coals in the world. There are estimated to be three and a half billion tons of bituminous coals within the entire country, and of

With the same NUCH has been said, these twenty years of runn fuel prices, about the Justs of the future and even about the fuels of the present. The present orthes developes on angle of the cases to which for too little attention has been paid. Mr. Gunberg rements as that all fuels—code, wead, also or what for the contract of the fuel profits out the moenteversible fact that conversion of solid or liquid mine a fig. (and makesy be done more cheeping and more officiently on a large scale in a special plant than on a processed scale in the consumer's oil store or coal frameso. Expo. he tells us, the fuel of the future is unquestionably gai, and the gas tone which adorn the loss ought to be the unserval appeals for heart, that and hower. It which we can think of only sone rejonder—Why not 1—The Editor

> this total, half a billion tons are found in that section this total, hair a billion tons are round in that section. There are also large deposits of soft coal in the West, Lignite coal to the extent of one billion tone is found in North Dakuts, Texas and Arkansas.
>
> Wood is also a sulfa fuel, but it does not possess any

great industrial importance. The only other solid in-

able for domestic use under the proper conditions and is also variable as an indistrict foot, builde its application in a particular form, however an inceffenging cotto, in the manufacture of steel. Chies is prefuseble to the control of the contr

There was a time when by far the larger part of our feel was solld, and anything size was more or less of a freak. Those legisled and ageones feels play a lange riche. The principal liquid freal in gas oil. This is a larger feel with the principal liquid freal in gas oil. This is a larger feel with the principal liquid freal in gas oil. This is seen to the control of the liquid part of the principal liquid freal in gas oil. This is seen in Naval vessels and the merchant marine ships use feel of Naval vessels and the merchant marine ships use feel of Naval vessels and the feed of the larger feel of the state of the larger feel of the larger feel of the state of the larger feel of the larger feel of the state of the larger feel There was a time when by far the larger part of

marily with one gas or water gas, when may or su-marized under the one beeding, city gas. Both are made from one—the one made from one—the one of the one in distillation of the one in an area of the one in an area of the one in the one in the one of the one in the one of the one in the one of th

by blowing steam through a bed of incandescent coal or coke. Neither has the high bed of incundescent coal or coke. Neither has the high calcrific power that is de-handed by law in most states, and hence gas oil must be cracked and the gassons prod-uci mixed with them in order to make a mixed gas of 800 or 900 B tm. per cubic frost. In considering gas as a fuel these are a number of funda-



It stands to reason that if a fuel is first gusfied before it is burned, the most efficient pusification will result in the greatest freie consult. Back store of furnace or any other apparatus that burns coal or coke in principally as go produce. The efficiency of such a produced the efficiency of such a produced the substance of the such as the such that the such as the such

The carbadisation or distillation of coal to give gan pidel other products as well which are of the highest importance in indextry. These products—benco, sulfate of annoxial, cide and tars, colo or coly matters of annoxial, cide and tars, colo or coly matters are recorded to the color of the process in a carried out at low temperatures. The more record development along these lines has been the captualisation of cost, arranged on shallow cast from plates, which form part of a conveying system, and are led over a bath of motent lead in a suitable over a bath of motten lead in a suitable furnace. The process is known as the Caracristi process and is being installed in one of the Ford plants. It is claimed that the yield is from 7000 to 8000 cubic feet of the yield is from 7000 to 8000 cubic face to 800 to 700 B to, flas per fort or coal, five gallons of motor spirit, twenty pounds of swiftest of amounting 25 to 30 gallons of low temperature oils and about 70 per fort of the swiftest of amounting the swiftest of amounting the swiftest of the swift of the swiftest of the swift of the swiftest of the swift of t

coat, come or antifractic coal and gas, that of these fuels gas can be burned with the greatest thermal efficiency. Coke or an-thractic coal may be burned with an effi-ciency of 60 to 65 per cent, soft coal with

thractic soal may be burned with an effication of 00 to 60 per cent, and rocal with
a conversal sold of the control of the
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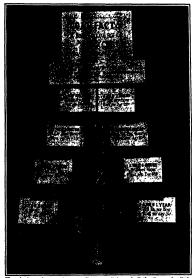
the gas.

Use today is being used for heating houses and as a tool in many industrial polats. Its use is seen increasing for those purposes, and it finds no difficulty in either the finds as a univowed. In various the desired a univowed. In various the desired of the seen of the se

adjusted to conform with focal concortions—and it must be remembered that it includes a single property of the control a lowering in the gas rate in one city or state with those that waital a higher rate in another state or town, for each case is individual and necessitate different beautiful control to the control to

hade before engineers of Public Service Commissions and gas experts, that there is very little difference in the sufferency of torming high- and low-beating value to the sufferency of torming high- and low-beating value of hest units in a gas in order to obtain high cumbration efficiency. Furthermore, it has been found by actual expertence with he low beating-value gas at a carried and the sufference of t fore engineers of Public Service C

cently a momentous decision was made by the Colo interesting a monetous section was made by the Colorado Public Service Commission in allowing each gas company within its jurisdiction to make gas of any quality that it finds to be best both economically and technically The price is then adjusted according to



Though the coal money is spent all at once, it is used all the time and a little at a time. The above graphic statement may help the coal user to realize that his fire costs money every time he puts a abovel of coal upon it

the cost of manufacture and the cost of service. The communer benefits directly, for he gets a cheaper gav-withch enables him to use it for purposes which wer-bervetobre exclusively the field of coal The gas com-pany benefits, for its bankess is enlarge fine accurapany benefits, for its business is enlarged and extended to new fields. The impetus toward the attainment of this condition must be given by the legal authorities in removing the disability that holds back the gas industry from performing its real function to society—a disability inherited from a day when the service rendered by gas was totally different from what it is now Gas can become the universal fuel It possesses all

Gas can become the universal fuel It possesses all the regulation of universality of usage. It represents the one logical solution of the fuel problem. When it replaces the use of coal and other fuels once for always in industry and in the home, we may say that a condition of maximum fuel economy will have been reached, the fuel attaction will have been put on a sound economic, technical and political basis.

The Laws of Vision and the Technique of Art He Laws of vision and the rectangue of Arts N an interesting paper published under the ampless of the Rumford Fund in the February Issue of the receedings of the American Academy, Messra. A Ames and C A Proctor and Miss Blanche Ames discuss the and C. A Proctor and these Bianche Ames quarter theory suggested by Hirsy Harrison, that a picture is most artistic when it reproduces our retinal impressions. The retinal picture is less distinct at the edges than at the center and is distorted in the "barret" manner, while the rithal itself is more senditive to blue near the edge than at the center. When a photograph near the edge than at the center. When a photographs of a landesque or building taken with a camers having a leas with the same properties as the eye is compared as the with the same properties as the eye is compared to the same properties as the eye is compared to the same properties when the same a static effect the exumining a number of pictures by distinguished artist, the authors have found evidence of the cosme ions or unconclous use by da Vinci, Resultment, Israelis, and the contract of the contrac

The Deepest Mines

BRAZIL still contains the mine that goes the despest below the surface of the earth, although the deepest below sea level and the nearest therefore to the center of the curth is in the United

The deepest hole in the earth is a gold mine in the state of Minas Geraes and is known as the Morro Velho or St John del

known as the Morro Velbo or 81, John del Rey nime. It is owned by the 83 John del Rey Mining Company, an English cor-poration, which has been working it al-most continuously slares 1834 most continuously slares 1834 most continuously slares 1834 most the post of the shart through which it is entered. The next deepent mine is in the Kolar gold field of India, where one shart descends to 6,140 freet The Villance 1899 min in South Africa The Villance 1899 min in South Africa Thirties (States is Thurayata No 5, a copper mine in the Lake Superior region, with a mine in the Lake Superior region, with a mine in the Laker Superior region, with a depth of 5 908 feet. The bottom of this shaft is 4,100 feet below the level of the sea, while that of the NI John del Rey is only 3,638 feet below see level, since the mouth of the shaft is in a mountain country 1,768 feet above sea level. The Tamarack mine goes nearest to the center of the earth

of the curth.

The timperature of the rock at the low set level of the %L John del Rey inthe is 117 degrees. The miners work in an air temperature of 18 degrees. The outside grees had been green before forced to the lowest levels from which it is drawn to the surface by powerful funs. On its way to the lowest depths it gains heat from the roke and from it nown compression, because air at the first in own compression, because air at them air at a set at the size and the size of the first in the size and the

The mine is a dry one, there being no the lime is a cry one, there is no water at the lower levels, and because of the low relative humidity of the air which has been dried before being forced into

has leven dried before being moved into
the nine, the men are able to work under
satisfactory conditions.
The '41 obta del fley mine is not only
the deepest mine in the world but is querated by the oblest redsterred flegible mining company, organized in 1830 to work a mine at a place some distance from the present workings. This mine proved to be unprofitable and in 1837 operations were trans-

ferred to the present site where they have since been

rerred to the present size where they have since seen carried on almost continuously. The deepest hole in the beforek foundation of the crust of the earth has been recently reported to have been deflied in South Africa. It is not the deepest from the surface but the point is that its 5,500 feet of depth. the surface but the point is that its 5,000 rect of depth is all in the pre-dumbrian strate, the underlying rocks is all in the pre-dumbrian strate, the underlying rocks of the pre-dumbrian strategy of the strategy of the line or no yearst ups. The other deep horse mentioned above are in pre-six of more recent formation, or even, especially in the case of the Tanarack staff, in super-post sediment, manifest of materials and the strategy of th

Three Wheels Versus Four

The Direction in Which the Development of the Economy Car is Pointed

By R. M. Sanders

N EVERY man's inner self from childhood days onward lies the devire to own a means to located or Yesterday it was a horse and carriage, or maybe a saddle horse, and today a nationative vehicle of some description. Millions of automobiles

have been produced, and still there are more people walking than riding Many people are in a position to purchase automobiles, so far as

the original cost is concerned but the fundamental thing is but the fundamental tonig is the small income earner cannot afford to operate even the low-est priced automobile on the market today. People therefore have become motorcycle and enr owners. The motorcycle and sidecar

The motorcycle and sideous combination is very economical to operate. We can easily realize this when it is possible to get from 40 to for miles per galino of guasoline and 2000 to 2500 miles per galino of guasoline and 2000 to 2500 miles per galino of inbeleating oil Thee, again, there are but three tires against four on the automobile, without con three trees against four on the automobile, without con-dicienting the fact that these three carry less weight per addering the fact that these three carry less weight per other and the control of the control of the con-trol of the control of the control of the con-trol of the control of the control of the con-trol per month for the smallest automobile is approxi-ted by the control of the control of the con-trol per month for the smallest automobile is approxi-ted by the control of the control of the con-trol of the control of the con-front the above figures that the cost of operation of the motor yele conditionation is far best time operating a

motor-ycle combination is far less than operating a small automobile. The wear and tear (cost of replace-ment parts) is also in favor of the "combination," due to the fewer warring parts on same. The satisfy that "inner self desire" of owning an auto-motive vehicle, and yet to be able to operate one within their income without secrificing other necessities, many people have purchased "combinations" in order to get people have purchased "combinations" in order to set out on the blights asys and byways of the country though it must be said that many purchase "solo" muchines (motorcycles) from a sporting dwepoint Unfortinately, after acquiring a "combination" we find that travelling on this type of vehicle. It is found that we must have special clothing or wear the oldset tops one may have. This applies to the guest who rides in the address one will also the combination of the

have the will and the desire to

A boon to small income earn-ers would be in their ability to purchase a three-wheeler, such as is being manufactured

abroad A three-wheeler is a light car (if you care to call it that), light in weight particularly. It is called a

call it that; light in weight particularly it is called a three-wheeler should by vitrue of the fact that it has a three-wheeler should by vitrue of the fact that it has sidewer, but of much illferent design and arrangement. The outstanding advantage of the three-wheeler over its perdessoor, the motorycle-and sidewer combination, is the comfort. The illrevs-liveled has a full seat uplud-secommodate two people comfortably side by side: The bedy as may be noted from the lituraterious, is built along automobile lines. The aprings of some of the inter-wheelers attend are of the infliciantiever type both front and rear Naturally, the comfort of riding both front and rear. Naturally, the comment of riguing in a three-wheeler on a well spring chaeses and in a roomy body is incomparable to the "combination." The driver of a "combination," usually, the owner has none of the comforts that his greet enjoys riding in the well spring and lavoriously fixed sidener. In the three-wheeler both ridirs are equally confortable. Anyone who has experienced the displeasure of being Anyone who has experienced the displeasure of being

auddenly overtaken by a rainstorm while driving on a motorcycle and sidecar will readily see the advantage the three-wheeler has over the combination. The sidecar is usually fitted with a windshield and top, but is car is usually increase with a wind-silved rand top, our is it fair to the owner-fider to be setted out in the open, subject to ravages of the elements? It is possible, of course, to keep comparatively dry on a monor-cycle if the rider dresses like a deep-sea diver but who wants to do that? As it is, once has to wear old clothes or

purchase special clothing. Whereas, when driving a three-wheeler, one can put on "Sunday-go-to-meeting" clothes and still enjoy the open country Thea, if bad weather is encountered, both riders have equal protec-

Sociability is a strong point in the favor of the threeeler, for it must be admitted by the most enthusi-e "combination" owner that it is exceedingly difficult

ser that it is exceedingly difficult to carry on a conversation with the fair rider of the sidecar. The fact that both the driver and the passenger are afforded equal protection from the elements and are seated side by side tends to make the longest journey a pleasure under the worst conditions in a three-wheeler. wheeler

Riders of three-wheelers are never conspicuous through difference in dress when attending a gathering inrugin difference in dress when attending a gatherin or at the theater, for they are able to ride to thes various places without the necessity of changing thei-ciothing upon arrival, whereas the "combination rider has to

The components used in the construction of the three-wheelers are similar to those of the motorcycle.

The engines used are mostly V types, of the same cubic dis-placement and general design, the only variation being in the placing of the clutch at the en-gine instead of at the transmisgine instead of at the transmis-sion. The cooling systems of the engines used abread are equally divided between the water-croiled and air-croiled V engines. The clutch of the three-w and the motorcycle are of the

same size in area and capacity, for both engines are of same size in area and capacity, for both engines are or the same displacement. The transmissions have approxi-mately the same number of gears, though three-wheelers are equipped with three-speed gear boxes, two speeds forward and one reverse, whereas the motorcycle has

The final drive is exactly the same as a motorcycle, as both drive via roller chain to a single rear wheel The brakes are also similarly located and are any amin'ny located and actuated, one contracting and one expanding, acting on the rear wheel Some of the three-wheelers are fitted with front-wheel brakes as well.

Let us now make a compari

son of the cost of operation be-tween the three-wheeler and the motorcycle and sidecar Abroad

the initial investment in other machines is approximately the same Inasunch as we have the same engine size, same number of wheels, same load and weight to curry it is lexical that the cost of operating the three control of the same in the curry in the lexical that the cost of operating the three control of the control of the cost of operating is less than the average motorcycle combination. The three-wheeler holds a record in oil—sae cosmup both in gaussime and in oil—sae communition of 51 miles per miles per collection of the control of t

mines per gamen or oil "Aire wear also is less than with the "combi-nation" So, with increased util-ity and less cost per mile, the three-wheeler is the most econom-

three-wheeler is the most econom-ical vehicle to operate.
When taking a general view of the three-wheeler from an engi-neering standpoint, we find that it consists merely of a rearrange ment of the components to make use of the maximum power avail able to produce the greatest rest

able to produce use greatest results.

In comparing the power application of both vehicles, let us suppose for example that we have a box to move. It is most likely that we would push at a point in the center of the rear of the box, to move it forward with the minimum of effort. It is quite evident that we would not push on one of the corners and expect it to

move forward without also using some additional effort to keep it in a straight path.

to keep it in a streight path.

The foregoing persparah illustrates the improper application of power to well-in law to the path of amounts of persons to well-in law to the path of amounts of the whole as the path of amounts of the whole as used in the three-wholesers abound to the wheels as used in the three-wholesers abound to the owners of the whole as used in the three-wholesers abound to the whole as used in the three-wholesers abound the owners of the law of the whole as used in the three-wholesers abound the owners of the law of the wholesers o diagonal, as illustrated with the box. The "combina-tion" has a tendency to turn around the sideers wheel when the vehicle is moving in a straight line. This ten-when the vehicle is moving in a straight line. This ten-when of the monorcycle ever in the opposite direction to overcome this tendency, thereby causing undue wears in the front tire of same. Naturally, this tire wears more than it would if it could travel in a straight line with the rear wheal of the motorcycle Again the three-ther rear wheal of the motorcycle Again the three-

the "combination," from an en-gineering standpoint it is ex-ceedingly far in advance of the motorcycle and sidecar with a given useful load and available horsepower Therefore, it is not only logical, but it has been proven, that the three-wheeler is more efficient than the "c bination."

The three-wheeler was made

The three-wheeler was made in small-scale production in 1910 and first exhibits a small-scale production in abov) that year. The ploneer firm is still going strong and its product has increased in demand as the three-wheeler industry grow. There are today in Europe seven manufacturers of the three-wheeler, which is a proven vehicle abroad. There has been very little or the proven vehicle abroad. There has been very little or the proven vehicle abroad. Then has been very little or the proven vehicle abroad. Then has been very little or the proven vehicle abroad. Then has been very little or the proven vehicle abroad. Then has been very little or the proven vehicle of the proven vehicle of the proven vehicle or the proven vehicle of the proven vehicle or the pro seven manufacturers of the three-wheeler, which is a proven which showd There has been very little change in general design during the past to reserve the provent which show a provent which show a provent the components are the provent which a shored we find that most manufacturers of three-wheelers and motorcrutes purchase their earliers which a shored we find that most manufacturers. The same evaditions perval as to our automobile field, which has proven so messenth through the standardization worst of the footery of automotive the standardization worst of the footery of automotive about play an important part in three-wheeler progress. The three-wheeler, in competition with the motorcrie confidence (server by owner-drivers) and factory machines (driven by owner-drivers) and factory machines. They shad the seconary proved of 671 miles per per hour. In Britain and on the Continent, many general competitions are one per hour, and many more pervide a support of the properties of the second provided and the second provided of the second provided the second provided for the per per hour. In Britain and on the Continent, many general competitions are one for them. The second automotive the second provided and the s

venopment, would seem altogether out of preportion to their im-portance, and correspondence co-uman indicate a very lively inter-est on the part of the readers in this type and its future. Dis-tinctly it ranks as a small car and not at all as a motorcycle, both in England and on the Con-

ler has a definite place to fill. It will The three-wheeler has a definite place to fill. It will ultimately replace the motorcycle and side-car, which is a compromise and a very poor compromise at that. The public has never demonded any new machine before it was displayed and demonstrated. Once the three-wheeler is introduced in this country to the public, it will be possible for the small-income errare to satisfy





that "innermost" desire to own and operate an auto-motive vehicle. There are many people in this class to whom the "combination" appears dangerous and myswhom the "combination" appears dangerous and mys-terious, due largely to the supcored units and necessity for special ciothing. It may be predicted that the three-wheeler will result many more enhusiast than the "combination," including a large percentage of the present "combination" branch.

The three-wheeler has one outstanding advantage which the motorcycle, with or without the side-cur. can

which the motorcycis, with or without the side-car, can never meet. It can carry a battery and ref-starter, and it has the reverse speed in its goar box. The absence of these makes the motorcycle fundamentally unsuited for general use by all members of the family but the three-wheeler is just as easily started and just us vasily immenurered, out of a tight spot by the weakest member

Gelatine to Eat and Gelatine for Glue

IN our October issue, in his article on curious foreign foods, Mr L. Lodian permitted his appreciation of a

time-honored jest to run away with bis disc blind him to facts. Mr Lodian, in speaking of Deift gelatine in speaking of Delft gelatine refers to "the well-stewed vis-cera of old hour" as the ruw material from which this prod-uct is made. As anybody familiar with our pure-food laws would realise, such a concection as he pictures would be quite

as he prefures would be quite unable to get past our castoms with louding important of this authentic points out to the louding important of this authentice points out to us, there are two grades of gulatine, one being for food and the other for give In Dorft, as everywhere else, the two are kept quite agent, and one can set Defit gulatine, or any other agent, and one can set Defit gulatine, or any other matter of regret to the SCERTHY AREACH that If an under the regret to the SCERTHY AREACH that If and of mindiffered humor, should have made a statement implying others ise, and that this channel of the property of the scenarios.

Trackless Trolley Details

THE use of trolley buses in kuropean countries has been covered in a very comprehensive way by Mr II. L. Andrews, Railway and Traction Engineering De-11. L. Andrews, Rollway and Triction Engineering Le-partment, General Electric Company, who points out that European countries have for a great many years successfully operated trackless trolleys. In 1920 there were in England twenty companies with more than 100 miles of trackless trolley installations operating or authorized, while Italy had eight companies, comprising total of 43.5 miles of route, and Germany had eight

installations for passenger and freight traffic. Fran Sweden and Austria have a number of installations in sucnumber of installations in suc-cessful operation. There are in use in Europe three general sys-tems—1st, Mercedes Stoll, 2nd, Filovia, 3rd, Max Schlemann all of which differ in the meth of drive and in the method of ollecting current.
The Mercedes Stoll system is

ementially a four-wheel drive although two-wheel drive installations have been made The driving motor is built into and

driving motor is built into and is a part of the driving wheel. The control is arranged to give air speeds and three electric brake positions. When used with the dress where the positions will be also also be able to the dress when dress when there is no support to the dress when the dress when the two back when instorts counted in series. The collector used with the Mensel of the dress when t connected in series. Insection used to consider the control of the overrunning or carrities type. The current collector at the trolley seed is composed of a frame having two small grooved wheels with ball bearings on each side, one pair running on each wite, A cable with a double wire hange down from the center of this frame or trolley and has a weighted pra-dulum which keeps the wheels well pressed down on the wires. This collector allows considerable movement the wires. This collector allows considerable movement from the trolleg wire, and extreme movement is taken care of by means of a cable and reel on the car which allows 80 or 85 feet radius from the center of the trolley. When vehicles operating in opposite direc-tions meet, the drivers exchange collectors and pluzs,

Hoss meet, the drivers exchange consecurs and putes, which are readily detachable and within easy reach. For the more part these trackies trollers weight proximately 6048 pounds, less load, and have a seating capacity of 25. In some few installations larger cars weighing over 11,000 pounds complete are used. One

installation is equipped to handle motor car and trailer cars, the motor cars having a seating capacity of 22 and the trailer cars of 20.

and the trailer cars of 20.

The Filovia system, which is in operation on more than 40 miles of route with eight different companies, has proved very successful. This system ad has proved very successful. This sys

mounted on the chassis and geared to a back shaft on which is mounted a sprocket wheel Transmission of nower to the rear whoels is by ns of a chain drive Es car is equipped with two 12car is equipped with two 12-horsepower motors. The collectors used are similar to those described with the Merceles Stoll system, except they are come ted to the bus proper by means of a rigid pole.

The Max Schlemann system has been employed extensively in Germany for both passenger and freight service. There are eight or more installations, three of enger service, four are entirely for freight and one handles

both freight and passengers. This system uses a two-motor drive, each motor being mounted on the truck chassis and geared to a back shaft by means of bevel gears. Power is transmitted to the rear wheels by a chain drive Three methods of collesting current are used with

this system list two trolley poles under running on the trolley wire 2nd, one trolley pole with a double head carrying two trolley wheels, 3rd overrunning carriage as described under the Mercedes Stoll system. This last method of collecting current has not produced good rewilter due to the demans result

ng from the curringe's leaving

William .

the trolley wire English practice differs what from any of the three systems previously described. Two motors are used, each he ing mounted on the truck chassis and connected to a jack shaft through worm gearing The jack shaft carries a sprocket wheel and power is transmitted to the driving driving eels by means of chain drive

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This practice of using two motors and the method of operation have been changed somewhat in the more recent installations, particularly the one in Shanghai, China On these buses two motors are used, mounted directly on the chassis, but the jack shaft and chain

gearing are omitted, the motors being connected direct to the driving axle, using worm gear-ing, each motor driving one of the rear wheels.

English operators who have used the gussilne-propelled bus more extensively than we have more extensively than we have until recently in this country, both independent of their rull-way systems and as feeders to their established lines, have stated that the gasoline propelled bus, so far as it has been

developed, cannot be operated at the same cost as the street car, and that they are not well adapted for stress car, and that they are not well adapted for hundling peak loads, but they have found the masoline bus well suited to operate as feeders or to cannect up existing street railway routes. The Paris transportation system is now operating transportation system is now operating

trolley buses in extension of trolley lines in rapidly growing suburban sections the United States and Canada recent

ine United States and Canada stallations have been made at Staten Island New York City, Bultimore Md. Richmond, Va., Minneapolis Mins. Los An-geles, Cal. Turonto and Windsor. Ontario

World Revolutions THE land surface of the globe has been, for the most part many times covered by the sea in the course of geological time

rth, as new known, have only recently attained their present elevation, other mountain ranges formerly existed which have now been all but obliterated by the remoraeless effects of long-continued denudation. It is important that we should study for a little what imports when a great mountain range is developed on nappens when a great mountain range is developed on the surface of the globe There is a long period of preparation for the stately event, a period many mil-lions of years in duration. First, there are signs of unrest in the solid land of the continents.

The sea rises on the coasts and transgresses on the wide lands within, very gradually stealing over the lower levels. This process the lower levels. This process may not be steady and continu our. There may be periods of retreat followed by periods of advance, but always the land as a whole goes on shitting deeper and deeper into the sea. Many millions of square miles may be covered with the shallow seas-

(TIME) covered with the shallow same-perhaps to a depth of two or more hundred fathous-so that a considerable portion of the land area of the globe may become see, before the downward movement cemes. This transactesion is a slow process as allow and long-enduring that, while the submergence lasts, great depths of sediment accumulate in the transgres-

sional seas. Then at length there comes a resurrection. The la begins to emerge, but not the old land which went down Where the great accumulations of sediment had been, mountain ranges arise. In short, what arises from the occur grave is a crushed and wrinkled world, shat tered by faults and over thrusts and exhibiting every evidence of great horizontal compression. One attendant of these events is the outbreak of volcanoes and floods of lava welling out of fissures in the earth's crust. The latter generally appear along western coasts, or to the

west of the new born mountain ranges.

These events draw to a close when the land has attained its former elevation more or less There is then a new era of geological history a long era of organic process.

lasting many millions of years, during which minor oscillation of the crust and local deforms tion may occur This is a period of active denudation. The last orn mountains are degraded by nudation, and their sediments collected into the great troughs or geosynclines, and the sublime but unreasoning sequence of events is repeated all over agnin

ettit.

Such has been in leisurely repetition the history of suca ans ocen in leisurely rejection the history of the earth Certain world revolutions are generally ac-cepted—although geologists are not all agreed as to their number—as comprised in the period of 150 or 170 million years which the statistics of denodation and the minion years when the starters of caronation and the record of thorium lead ascribe to the age of our era Four or five world revolutions appear to enter into that time interval. Thus 30 or more millions of years may, tentatively, be ascribed to the genesis and consumma tion of a world-revolution -Pro n an address by Prof J Joly, PRS, before the Royal Dublin Society

The Relation of Suicide to Climatic and Other Factors

IN A recent number of the American Journal of Hygicae, Dr. J. R. Miner presents the results of an extensive statistical analysis of the relation of suicide to climatic and racial factors, and to industris occupation urban conditions, age, and sex. It has long been recognised that the suicide rate is higher among the Nordic race than among Alpine or Mediterrane peoples, Mixed peoples usually have a higher rate the either of the pure races to which they belong Foreign ers in New York show a higher

sulcide rate than in the countries from which they came The lowest rute is found in Ireland and the highest in Saxony, while the rate varies in different parts of France according to the rucial composi-Asiatic peoples, the Japanese and Chinese rates are high and Chinese rates are high, while in India it is low (48 per 100 000) India appears to be the only country where female suicides exceed the male The general trend of spicide rates has been upward during the

rates tend to become stabilized Germany France, Den mark and Sweden have high rates. Britain, Norway and the Netherlands low rates. In the United States the rates are lowest in the south and highest in the west.



Our Point of View

Radio in the Frozen North

AbJiO, among other accomplishments, has related by the present of the present of

Last March a dinner was in progress in honor of Dr Donald B MacMillan, the famous arctic explorer Several inval officers were present. Dr MacMillan, in the course of a little dinner talk, made the following

simificant statement

"You naval men and yachtamen have not the slightest idea of what the real hardship of the North it is not the lack of food, because I have proven that we can live for three years or indefinitely, on the food of the foodino. It is not the cold, because we have proven that if we eat and drows as the foodino, we can stand as much cold as he. It is the solitude—every-librag gaing out and nothing coming in. No can to take to besides our own party of seven men except a few maninghanture Eadhimo, who grow very threema Arctic explorers have in the past been forced to shoot that carries and the past deep forced to shoot that the first control of the solitude."

At this point Dr MacMilian was asked why he did not take an efficient radio apparatus with him, and his SDEWOT WAS "In my 87 foot boat space is so valuable that we could not afford to give up the room neces-BRIT " Yet on his past expedition he took a small radio set requiring very little room, which radio set proved ctive. So Dr MacMillan was asked "Well, doctor, fully 50 per cent of your space in the hold of your ship is given to food which you tell us you can do without Why not give up some of that space to overcome the real hardship of the North?" His answer was to the effect that he had never looked at the question from that angle Subsequently, and in preparation for his present expedition, the explorer gave up not the space in his hold but two very valuable berths in the forward end of the fore-castle of his schooner "Bowdoin, ' to a powerful transmitter so that he might keep in touch with civilization

And so our intrepid arctic explorer of today is keeping in touch with us from his frozen berth in the arctic wilderness. Dr MacMillan's messages are coming back at frequent intervals, even though he is now frozen in for the winter at Refuge Harbor on the northwest coast of Greenland, within 11 degrees of the North Pole When it was first announced that he we to take both radio receiving and sending apparatus into the arctic many engineers and eclentists said that he would never be able to penetrate the curtain of the auroral band with radio messages. This has been dis-When Dr MacMillan first arrived inside the auroral band it was difficult to get messages back because of the fact that he was on 24 hours daylight, but now that he has a period of darkness the messages are coming back with great regularity. The American Radio Reiny League, composed of the amateurs of the United States and Canada, sent Mr Donald Mix, an expert radio operator, with the MacMillan expediti and all the anuteurs are standing by nightly in their endeavors to hear MacMillan.

So much for the "going out" part of radio. But how about the "coming in' part? That is the feature which combats the worst terror of arctic exploration—soli-

Simple enough. Our broadcasting stations take care of the arctic explorers. Each Wednesday evening at midnight, Central Standard Time, we talk to Dr. Mac-Millian from the Seatilo Edgewater Beach Hetel broadcasting station, WJAZ, and give him not only a refurme of the week's news, but also the messages from his friends and relatives and from the friends and relatives of his crew of seven men. And this takes place in the spoken word, please note, and not the awkward and slow der-dash code of the reddo telegraph Aside from this personal service. MecMillan and his men are caloying radio programs to the utmost—music, talks, sporting events, and so on. Where is the solitude of the far North!

The Laborer and His Hire

THE series which has now come to carry the title "Paychia chavatures," the articles describing Mr Bird's expeciences with Messars, Rioan, Powell and Hyop placed emphasis upon the claim that these mediums also not profit formationally from their mediumship. In advantage this financially from their mediumship. In advantage this manufacture of the series of the serie

Since the appearance of the articles in question, we have heard from Mr. McKenet, of the British College of Psychic Science. It is through Mrs. McKenet, and the articles are under, and when the speaks, we may substitute, for the belieft that "ought to known" what she is talking about, the positive assurance that she does know The facts, according to Mrs. McKenets, are not quite so simple as they had been made to appear by those sugger to put the meditums in the most furvershie light possible.

Mr. Vloan, so long as he remained in Glasgow, literally received not a peany for his meditionable. When conecting the common labor, paying that minet; shillings per week—well above the prevailing scale for such work, and in addition, from College funds, one pound per week was laid adde for his against emergence.

Mr Powell gives many slittings to his friends, either with no charge or with the mere resulation of his expenses. But when he comes to London, he leaves his business for a week at a time, and it is at once proper and necessary that his receive compensation for this. Mrs. McKentis does not speak in pounds and shillings here, but she characterises the few which Mr and the contraction of the College as "Amadone" "

Mr. Hope has calculated what he could sam at the carpentr's herein in the time occupied by a photographic senice, and has fixed a charge accordingly. But this charge supplies only to those who go to him at Crewe, and even thee, many sitters give him a two many control of the country of the

The spiritualists who in argument sitile over and some failty five facts, do so with no realisation that they are misrepresenting. They are firmly convinced to the good failt of their mediums, and are imported with the large subtimal satisfaction which the sonargives for a comparatively manil return. Feeling so strongly that the medium gives more than he gets, they rush to his declares when the implication is made that he works for money. And they defend him now wissly, tut too wall.

Stean while in Lendon derived, Powell and Hope habitually derive, no small part of their livelihood their needlumable. Our agritualistic friends would do far better to face this fact than to seek to explain a way. For the medium devotes a very considerable part of his time to his needlumable, and in a day when money alone makes the mare go, why should be not receive a fair recei

The condemnation of a medium on the more ground that he accept free, the limplication that he seek that he accept free, the limplication that he accept that he are without pay, has always impressed us as the height of hypocriary Of course to the binata with whose windows widows out of their insurances meaning whose windows widows out of their insurances meaning through "measurese" from their decessed beautions these remarks do not apply We apact only of the medium who gives ordinary seasons at a fixed or still-medium who gives ordinary seasons at a fixed or still-

ing fee and guts to collique return from his meditionship. For after all, went a medium must live. Nobody has ever suggested that the dector ought to have a folio, one side, as carposter or back driver, carning he live life from this and giving such this as he can spare from it to the prattitude healing of disease. Nobody has ever argued that the priest or the minister ought to take in washing to ougher thimself, marrying and burying people and healing spiritual sores gratifs, between turns at the wringer The medium, to the people he serves, and the priest of the people has the part of the people has the people people

Unite Atlantic and Pacific Fleets in One

III American Lagim, in Annual Convention in 1922, adopted unanimously the following resolution "We believe that all combetant in one float for jury control to concentrate in one float for purposes of better training and more communical administration, further, that this float should be based where it can be maintained and administered at the least cost to our government."

Our late President saured as that the Federal Government will have to practice economy for many years to come. This is true of every department of the government, and since the Navy spends annually more than 300 millions of our rewards, it should practice rigid economy and stop only at the point where further reduction of expense would interfere with efficiency

Now, one direction in which a large reduction in expenditure could be secured, is to reunite our presen disunited, first line battle fleet. For nearly twenty years before the World War, our first-line battleships were concentrated in a single fleet, based in the Atlantic, but in 1920, apparently for political reasons. Secretary Daniels split the fleet in half, placing part in the Pacific and part in the Atlantic The moving of the more powerful half of our battle fleet fato the Pacific together with Mr Daniels program for building sixteen battleships, produced considerable anxiety in Japan and iter-building program was started in that country Happily, we have agreed to a 5-S ratio as regards Japan, with no development of naval bases west of Hawaii, and have signed the Four-Power Treaty for the settlement of any future difficulties in the Pacific. regards that ocean, our Secretary of State has assured us that there is now not a cloud in the horizon.

There was never any sound military reason for spliting up our battle fiest, navel opinion insided was all against it. Our abbest strategist, Admiral Mahan, long age warned the American pooling against dividing our fiest between the Pacific and Atlantic. The attributed and against the American pooling against dividing our largely to the fact that it was divided the Sepanson Largely to the fact that it was divided the same," but defeated in detail "It is precisely the same," but woto "in application as well as in principle, with the Atlantic and Pacific coasts of the United States. Concentration protests both coasts, division exposes

Concentration makes for efficiency. The larges the fiset, the better training it affects both for offences and men, since the massevers are more realistic and since the more exactly those that would be required in lattice. The bettle first is a team, and fram work is all parts about the lattice of the lattice of the lattice but it is a superior of the lattice of the lattice of the but it is a superior of the lattice of the lattice of the but first and the lattice of the lattice of

Concentration of the first, furthermore, would causil in marield economy. Our callinguist and organization consolidate to eliminate overland and redoce exposer: or battle feet must do the same to reach the same end. With the fleets united, fewer admirals with their numerous staffs would be required. There are houghtain align, supply ships, trags, etc. serving the battle fleet, in the Fatific, and identical vessues serving the battle fleet in the Athantio. Occasionation with elimination and the same and the same armillations, and make a married rydge-many of these smallination, and make a married rydge-

Our Point of View

tion in the number of officers and men then required But where shall the united single fleet be based? Now that the so-called Japanese menace has vanished, re is every reason why the fleet should be based in the Atlantic. Let us consider some of these reasons. In the first place, there are eighteen states bordering the Atlantic, while only three border the Pacific, and those Atlantic states provided in 1920 for the upkrey of the Navy elevan times as much revenue as those on the Pacific seaboard. More than three-quarters of all our states and 92 per cent of the population of the country have a natural outlet on the Atlantic, and they provide 94 per cent of the money spent by the Navy Basing half of our fleet in the Pacific, so far away from the center of population, brings added expense and waste of time in transporting officers and their wives and families out to the Pacific and then back again at the end of their tours of duty Several naval transports are now engaged in this work

Since the industrial centers of the United States are in the east, it follows that most of the ammunition, stores, equipment, etc., are manufactured in the east, and half of these, if the feet is divided, must make the long and costly transit by sea to the Pacific coast, thereby adding greatly to the expense.

Last, but by no means least important consideration in favor of a single fleet, is the fact that the Atlantic seeboard has had many millions spent on it to develop Navy yards and bases for handling our battle fleet. Today these are all operating at reduced efficiency, with high overhead expense, because most of the work for which they were designed is now being diverted to the West Coast, where plans are on foot to spend millions more of the public's money in developing bases, which can just as well wait until there is more money in the reasing like as well wait until there is more money in the Treasury for such purposes. This is no time to spend millions in building up new Navy yards, when there are ample facilities for handling the whole fleet in the Atlantic.

Hudson River Bridge and the War Department HE PROTECTION of our rivers and harbors against private encronchment is one of the important duties of the War Department Before any bridge can be thrown across a navigable river or any other kind of waterway, it must receive the sanction of the Army Engineers. It was because of these conditions that a public meeting was held recently in the Army Building, New York, for the purpose of hearing the arguments for and against the great bridge which is proposed across the Hudson River, at or near Fifty-ninth Street It augurs well for the future of this great enterprise that the meeting was crowded, and that some forty letters in approval of the bridge had been received as against three or four against it.

The principal objection, as voiced at the meeting, came from an unexpected quarter and certainly in an mal form. We refer to the claim of one of the leading trans-Atlantic steamship companies, that, although the bridge was located as far up the river as Fifty-sinth Street, it was yet so far down the river that it might prove to be an obstruction to the maneuvering of the larger ships when they are entering or leaving their piers. It seems that the masts of a of these vessels extend 200 feet into the air, or 50 feet or than the bottom of the proposed bridge.

To those of us who are familiar with the Hudson River, the location of the piers of the great st companies, and the manner in which the biggest ships companes, and the manner in water the tagger sulp-are swams across the stream and coared into their berths, it will seem rather absurd to claim that a bridge which is one-third of a mile distant from the plea-could interface with the docking maneuvers. A capable captain, in making for a pier, does not over-shoot the early by twice the length of his own ship, and if he uld do so he would prove himself to be incompetent of a candidate for reprimend or dismissal. The

the city, which now asks that, in return, they shall do nothing to obstruct a great project which aims at the solution of one of the most pressing transportation problems of the city and the Metropolitan District.

The Industrial Fellowship System

HEN future historians tell the story of the industrial development of the Twentieth Century, if they have a just sense of proportion they will lay due emphasis upon the in creasing cooperation between industry and science which has been such an outstanding fact of the past ing articles contributed by the late Dr Robert Kennedy Duncan upon the Industrial Fellowship System of which he was the originator. This was placed in experi ntal operation primarily at the University of Kans in 1907, and it was inaugurated at the University of Pittsburgh in 1911 Two years later, the present Secretary of the Treasury and his brother established the Mellon Institute of Industrial Research on a permanent basis, and their continued financial support has made it possible to being the system up to its pre

What is the Industrial Fellowship System? Its aim is to promote industrial success through scientific research, that is to say, to find new materials and new s for industrial development, and to adva manufacturing through the application of scientific methods to industry. Its methods of operation are as follows an individual industrialist, a company, or an association of manufacturers, having a suitable problent, or several of them, requiring investigation, may become the denor of an Industrial Fellowship, provided that the problems are of sufficient scope to warrant the services of at least one man for a period of at least one year, and provided, also, that there is no other investigution in process in the Institute on the topic suggested by the prospective donor Thanks to the generosity of Secretary Melion, the Institution is entirely indepen and derives no financial profit from the investigations which it undertakes Therefore, it is in no sense of a commercial nature Furthermore, the executive staff of the Fellowship devotes itself to the interests of the Institute (which, by the way, is a part of the University of Pittsburgh), without outside rem

It should be explained here that the denor provides a foundation sum sufficient to cover the annual cost of the Fellowship including operative charges, purchases of all necessary apparatus, and pays the salary of the arch mun or min selected to work on the particular problem. The Institution on its part selects the Industrial Fellow for the particular investigation which is en trusted to him and to this he devotes his entire time Also, it furnishes laboratory, library and consulative facilities, but all results obtained by the Industrial Followship belong excludedly to the dot

Although the results of the investigation are confiden tial, many of the valuable data obtained are, by the courtesy of the donor, available for publicity and, as our readers are aware, no small part of this material has appeared from time to time in the SCIENTIFIC

High-Speed Electric Traction

A recent issue, under the heading "How fast shall we travel," it was shown that from fifty to sixty miles an hour is the maximum schedule speed on the best appointed railroads here and in Europe. The limiting factor is the length and weight of the trains which are necessary to me be possible to make a considerable increase in the speed of express trains only by reducing their size and passenger capacity To haul a steam train of twelve to fourteen heavy cars at an average speed of from sixty to seventy miles an hour would call for a weight of engine beyond the capacity of our existing tracks, bridges and tunnel clearances.

If the speed of future milroad travel is to be materially increased, it can be done only by the adoption of electric traction and the use of multiple-unit trains. The multiple-unit method permits of a great increase in the total horsepower without exceeding the loading limit for rails, bridges and structures.

The fastest speed ever made on a railroad was achieved some 20 years ago in Germany, on a military railroad between Berlin and Zossen, where some costly experiments were carried on to ascertain how high a speed could be obtained on steam railroads under electric traction, and at what expenditure of power The experimental runs were progressive. The speed soon passed the 100 mile per hour mark, and then rose, successively, to 110, 120 and finally to 130 miles per hour The limiting conditions were found to be not in the car but in the track, which proved to be unable to stand up under the severe stresses imposed upon it, and this in unite of the fact that it was specially prepared for these trials.

We are thus brought to the conclusion that schedule eeds of 100 miles an hour can be attained only where the topography is favorable to fairly level and straight tines. Even under these conditions it would be noces sary to design a special roadhed and track of costly construction, involving many tunnels, long and costly embankments, the elevation or depression of the tracks through all towns and cities, and the complete elimination of grade crossings Also, the road would have to be equipped with some form of automatic train control, simple, rugged, and absolutely reliable

But when, if ever, such a road were built its cost both for construction and maintenance would be so great that its use would be restricted to those whose purse was deep or who, by reason of emergency, w willing to pay a high price for an extra forty to fifty miles per hour of speed

Thoughts on the Threatened Timber Famine

IIAT WE had to say in our September issue on the posthiffty of a timber famile has brought to this office a thought follows: to this office a thoughtful letter from Mr James D I Wood, in which he suggests that in considering the world's diminishing supplies, a distinction should be made between conferous woods and hardwoods, and directs attention to the vast area of hardwoods in the tropies which has jet hardly been touched When the scarcity of conferous woods beomes so much a fact us to raise the prices of lumber, it will be more profitable, be believes, to take out many of these tropical hardwoods than to attempt to raise the comparatively slow growing hardwoods in our more

Then the question is asked, whether it would not be wise to consider conservation under the two separate heads of protecting our watersheds and of carrying on forestry as a paying proposition. The Weeks law and other similar statues afford protection to watersheds and natural parks, but, according to our correspondent. "it yet remains to be demonstrated what policy will best prevent a timber famine," and the work of the Forestry Products Laboratory at Madison, much of which has been described in the Scientific American, is referred to as giving the country much valuable assistance in rest conservation. The greatest enemy of our forests, the one that does far more damage than the axe of the lumber man, is the annual forest fires. The government is doing much to combat the fire menace. Congress should furnish it with funds to do much more

In his plea for putting the question of timber preservation on a strict business basis, our corresponde whether it would not be false economy to plant all wast lands simply because they are waste. It should be done only when it is certain that such lands would yield a profit in return, and the suggestion is made, that because of the more rapid growth of timber in the south ern than in the northern central states, it might be more profitable to do our planting in the southern states, even though the freight rates remain high.

Another Mediumistic Failure

Our Committee Sees "Independent Writing" Produced by Substitution of Cards

By J. Malcolm Bird, Secretary to the Committee of Judges



IIILE Sir Arthur Conan Doyle was touring this country last Summer, he met a medium residing in one of our mid-westinedium residing in one or our mid-week-ern cities. He had no opportunity for a sitting with her, but she showed him a large quantity of affidavits which had been given her by persons who had sail and been con-

vinced that she was genuine. The face value of these documents was such as to impress him strongly, and he

brought her mediumship to our atten-tion. We communicated with her, and she agreed to come to New York and alt for our Committee

The ornamental material on these pages will have caught the reader's eye and informed him that he is to be told the story of an attempt to pro-duce paychic phenomena through fraud But as we have often couplin stred, we are investigating, not needi ums, but phenomena The identity of an unsuccessful medium—even of a fraudulent one—is therefore no porti nent part of our story, and we shall withhold this lady's name, as we with-held that of our medium of last May

rtly through corresponde partly through personal interview after the medium's arrival in New York, we learned the general charac-ter and the procedure of her manifes-

ter and the procedure of her manifestations. Their classification would be independent writing The messages are produced upon pieces of eard or paper, through the apparent instru
The forever used must be of colors recognised by the medium as "noft." From them she breaks off a quantity of petals and leaves. For the reception of the mysterious writings she habitually to pitals and leaves. For the reception of the mysterious writings she habitually to pitals and leaves. For the reception of the mysterious writings she habitually by three links. At a single strack she habitually to the links of the mysterious writings and leaves. The first step is the links of the mysterious writings and leaves the pitals of the mysterious writings and leaves the pitals of the mysterious writings and leaves the mysterious writings are mysterious writings and leaves the mysterious writings and leaves

The first step is to place the fragments of the flowers among the cards. No attempt is made to get petals or leaves between every two cards, they are me in considerable quantity here and

in considerable quantity here and there through the pile When this has been done, the curds, of course, are rather wabbly, and cannot be stacked accurately Mrs. Y takes the pile loosely in her right hand, and the usual procedure is to hold it over the usual procedure is to hold it over the head of some member of the group-whom she recognizes as her "oppo-site 'She characterisass herself as magnetic, and requires that the 'bat-tery,' as ahe cuils the collaborator, shall be 'electric'. 'She gravitates toward make in preference to females and toward dark complexions rather than light. After bolding the cerel determinate period, it is found, to unter her own exchantion, that "the quote her own explanation, that "the quite her own explanation, that "the coloring matter of the flowers has been precipitated by the psychic oper-ators to form written messages upon the cards' These messages are not as one might infer from their mode of le of as one might inter from their mode or production done in wide sloppy lines. The effect is entirely that of actual pennanship in colored inks. The me-dium does not profess to understand the details of the process, all she claims to know is the procedure, and

chaims to know as the procedure, and the fact that the messages appear. In any attempt at independent writing the identity of the permanship is always of great interest. Mrs. Y, in response to questions, explained that she has a spirit guide named Rible Rible, if I may berrow from one of the local reporters, is a nort of stemographer of the beyond She has her own characteristic penman-ship, and the messages are often in it Sometimes, how-ever, the signature is different, and may or may not be

establishable as that of the alleged communicator Mrs. establishable as tant or the autered commitmentor mark, therefore, represents Effice as actually writing to the communicant's dictation, and as sometimes algaing the name herself, sometimes leaving that to him. Sometimes, however we were fold, the entire message is in a permansably which is presumed to be that of the conmunicant, sometimes it is distinctly recognizable as that of the battery", and other alternatives occur occa-sionally Direct personal messages from Kfle are often

This "spirit measage," from a man whom at the memont the sitters supposed to be living, is in a brilliant gold pigment, which under microscopic examination shows actual metallic crystals

obtained, presumbly always in suitable chiesenship. The Bildross and committeesness in advance, and several sitters during the seances, asked the medium where in the pile of earth, the writings usually ceme On this point size centradicted herest? rejectedly Now size controlled benefit rejectedly Now size that the controlled for the point size centradicted herest? rejectedly Now also carried sightlining flowers, now that they would come on the three or four bettum or top curds, and several times when the carried were examined for possible writings



This distinguished communicant, on the other hand, writes in a reddish finid ink which, under extremely high magnification, shows no grain or other structure. Structure of the ander extremely high magnification, shows no grain or other structure. Stray crystals of gold here and there indicate that this card was written with the same brush as the one pictured above

she insisted that the searcher look at every card. These contradictions were repeated so flagrantly from day to day that the attention of the most sympathetic sitters was drawn to them.

was drawn to them.

If the phenomenon just described occurred genuinely, it would, of course, be one of the most extraordinary of all gaychic manifestations. Indeed, it would probably be quite unique, none of our investigators had ever before

encountered claims remotely approaching Mrs. Ys. I shall, therefore, make it quite clear, before taking up any of the collateral aspects of the sittings, just how we know that the writings produ

not groute.
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Now and again she tore up one or more cards, as soiled. Mr Lehmann at one stage made a mild attempt to at one stage made a mild attempt to take these fragments from her and throw them in the waste basket. It was not at all a determined effort, nor one that Mrs. Y would have had to exert herself to defeat. She did de-feat it, retaining the fragments to the end of the sitting, when she handed them to another sitter for destruction

them to another situe for destruction. After the medium had goes, the room was thoroughly searched and all regaments of the cards recovered. None of them had been term into the cards and it was possible to small cleen, and it was possible to make the card of the cards of the ca substitution of previously prepared cards. With our flowers, our cards,

and our conditions, we were none reluctant to believe that the writing could be actually manufactured that the writing could be actually manufactured, and the conditions of the conditions of the could have no idea whether our own cards were to be substituted beck, or whether they were to be used as samples from which where cards would be obtained for this purpose, because the could be produced whether the could be produced under it would be limited.

Would be limited.

Would be limited.

once on Indiscay, the 11th, we had to meet both these possibilities. The medium, on turning over to me the cards that remained after Tuesday's session, had requested that these idenseason, and requested that these iden-tical cards be employed on Thursday, since "they would probably have a lot of magnetism left in them" from her handling. After I had rejected a few badly stained ones, there remained 83 cards. These were marked by tiny pin pricks in one corner of each card, and all the cards placed with their marked all the caras placed with their marked sides down. The lady, however, whether by accident or because she is a good psychologist, turned the pack-age over in placing it upon her little age over in placing it upon her little work table. She sat down at this table and, under pretense of looking for dirty cards, examined the pack. The first four or five cards she scru-

The first four or five outs als extended from the finish which, the finish with an extreme of care quite incompatible with this explanation, then, looking for all the world like a Stray crystale so brush as the south of the first south of th

ore them so minutely that, within a reasor tore them so ministrate that, within a reasonable time, I couldn't patch them together into whole cards. So I weighed them, and found that the fragments were exactly equivalent to eithic cards, thince we had got back 25 whole saids, the account business for this seeme. I could not avoid the conclusion that the edium had hoped to make this accounting impossible, and thus to d hus to destroy our confidence in any accounting we might think we had made for the previous

had anticipated, and indeed had rather hoped, we sas anticipated, and indeed had rather hoped, that the pin marks might be found They had served their purpose, for future sittings we had adopted a different plan, and we were ver, grad to have the needtum's attention turned toward such things as pin pricks. Packages of 49 cards had been made up, and sent to the trimmer. For the third sitting, held in this office on Monday, the 15th, we had three such pack ages. Off the cards of one, 1/32 inch had been trimmed ages. On the carus or one, 1/32 inch had been trimmed, off those of the second, 2/32, off those of the third, 3/32. The frimming was at the end, leaving the height of the cards unaltered. This expedient had been de tided upon after the first sitting, during which we had ob-

upon after the first stiting, during which we had observed first the manner in which the medium held the cards, and the presence of flowers, etc., between them, and the presence of flowers, etc., between them, the cards and the presence of flowers, and the presence of the cards and the cards are missing at the end of the seasor, after which I destroyed sixteen on account of stains. Like the first and second stitings, this one was wholly blank in its results. section sittings, this one was wholly blank in its results, and we were beginning it wonder whether we should have to send Mrs. Y home without having seen her writings. Toward the end of the sitting, while the possible reasons for the repeated failures were being discussed, it was suggested that we go to the open air for cussed, it was suggested that we go to the open air for our next meeting Mrs. Ned Wayburn, of Bayalde, I. I, was present as a guest of the staff, and she offered the use of her lawn. The sitting at which the writings were finally obtained was therefore held in the country on lay, the 16th.

Nuesday, the 16th.
Mrs. Warburn and I supplied the necessary transportation I took with me all three sets of trimmed pertains I took with me all three sets of trimmed pertains I took with me all three sets of trimmed pertains I took with a pertain I took to the I took I took

drawn and five substituted.

Owing to the presence of the Times reporter, and to the accessity that two of the company get back to the city quickly, all examination of the cards was deferred, nor, once this was started, was deferred, nor, once this was started, or elaborate a process it inspire it is the weep obvious and non-committed and the control of the present it appeared in various newspapers would it appeared in various newspapers would be supported by the company of the com sad need of renewing its acquaint with the dictionary, so far at least as words are concerned.

All the cards from the sitting were put in one package, and deposited in my pocket. In my car I took the reporter, Mr Lescarboura and Drs. Carrington and Prince Mr Jones we dropped at Fifth Avenue, Dr Carrington at Columbus Cir-cle, Mr Lescarboura at 125th Street, Dr Prince I drove all the way home to Mont Prince I drove all the way home to Moni-clair Dropping him there at 9 o'clock, I reached my own home in Scotch Plains at 9 45, and within three-quarters of an hour I was able to call Mr Lescarbours at ton and assure him that substitution

The most damning item was that of length The five cards bearing writing were all of the name length as those used at our first sitting, and therefore 1/82 and

as our new sitting, and therefore 1/82 and 3/83 inch longer than those which we put in circulation at Rayaide. Their number, however, was a coincidence; they were not our misaing eards from the first atting, substituted back, as the following facts

In color they deviate from our cards to a surprising degree. To a score of persons I have handed a pack of six cards—the five writtes ones, plus one of ours—so arranged as to expose a little of the blank end of each

card. In no case has there been a failure to distinguish our card instantly Our cards are a brilliant white, the medium's decidedly grayish The micrometer shows further variation In ten The micrometer shows further variation in ten thousandits of an inch, the written cards gage, one 120½, two 121 and two 121½ Gaging about a hundred of our cards, the thinnest 1 find is comfortably over 122, the average is a shade over 123. Gaging in groups of fave confirms that the

written cards average a full two ten thousandths thinner

An even more startling way of putting this will be evident if we putting this will be evident if we realise that all of the written curds are thinner than any of ours. Approximately 100 curds were at the medium's disposal were at the medium's disposal for this sitting Selecting five of these at random, for spirit writ-ing or any other purpose, what is the chance of hitting upon the thinnest five? Approximately one in ten billion!

Nor is this all If actually roor is this all it actually from our supply, the five written cards were subject to my prelim hary selection as well as to the final one by the "spirits," the figure for selection from among igure for selection from among 500 then applies, rather than that from among 100 If, as appears the fact, they are really the thin nest five of the entire lot, the chance of their accidental choice

is one in 150 trillions!

Ninety of our cards (the full length ones, as next at our first sength once, as used at our first sitting) weigh 94 ounces. One ounce being equivalent to 2835 grams, the weight per card may be calculated to be 2 96 grams, on

The medium's cards, weigh them, carry the writing, which has a very super-cible weight when measured on a delicate chemical balance. But, even with this handlers, our cards are the super-super-super-super-super-super-super-super-super-ties. The content of the super-sup weigh them, carry the writing, which has a very appre-

Finally, the texture of the written-on cards is quite different from that of the cards supplied by us. Our stationer has examined both kinds with his expert eye,

tice substitution under our very eyes. Not necessarily how she did, but at least how she could. On this point a preliminary remark is in order Our conditions are in no case worked out with the view of preventing a neclum from operating fraudulently. The last thing we want is to be obliged to report that no phenomena were produced If the medium is a fraud, our tusk is to make him think that it is safe for him to do his stuff,

it is safe for him to do his stuff, while at the same time providing means for detecting him. It was with this viewpoint that we set up the conditions for Mrs. The performance Take or genuite we had to have conditions under which she could and would work We should not have searched her at all, save a they own indistinct on the first diffuse to me, office and Mrs.

891

sitting in our office, and Mrs. Bird, Mrs. Lescarboura and three strongraphers disrobed and exam-ined her to their best ability, in a private office. She did not insist at the second or third sit ting, but at Bayside she did insist. Mrs. Wayburn and her mother accordingly did the hon ors Mrs Wayburn reports that, after being sourched but before resuming all her garments, the medium stepped into the bathroom, alone, for a short time

A skilled operator would, we plieve, have confidence that she would be able to conceal a few small index cards where no amateur searcher could find them. But they would then doubtless be inaccessible to herself she would need a moment alone, before get-ting herself fully clothed, to transfer them to a more con-had already been searched. Or

venient place, which venient piace, which had already been searched. Or she might have planted them in the bathroom before the warch and gone there partly dressed to recover and conceal them on her person. The circumstances were such as to make this possible, but we prefer the other alternative. In any event, we must insist that our "search" of the medium be not taken seriously.

On the law meaning on traces serious;)
On the law, the medium complained of the chill, though in our office she had found warmth rather than cooliness unconfortable and inhibitive. She asked for an overcost, and Mr Jones supplied his—ir regular horse-blanket of an overcost, with Immense pockets, and the medium "warmed her hands" in those pockets, and

were the east throughout the siting

For the critical moment when the final
sity of the substitution was achieved, I
must full back on Dr Prince s observa
tions, At all sittings be had been waitations, at all sittings be had been waitations. At all sittings he had been watching for the occurrence of a blind angle, behind or beside the medium, so placed that in their positions of the moment none of the sitters could see into it. In our office, when not actually surrounded by the auditment the wedlers here. once the medium had faced such a wide semi-circle that no blind spot could exist. Moreover, her back was to an open court across which our clerks were looking on Mrs. I was uneasy and suspicious about this, even after we drew the curtains on

the offending windows
At Bayside, after several rearrange At Hayside, after several rearrange-ments, the condition diagrammed was ulti-mately brought about, with the audience in a long narrow horseshoe, Dr Carring-ton on one horn and his immediate neigh bors robbed of some freedom of motion by the fact that they sat together on benches rather than alone on chairs From here I quote Dr Prince's report to me

"Mrs. Y's practice is to place the pack upon the head of some person present and she has made great show of holding out her left arm at the supposedly decisive moment, to show that it has nothing to do with the phenomena But finally at Bay-side, when Dr Carrington was scated at right of the semi-circle, she placed the

the extreme right of the semi-circle, she placed the cards upon his head raking a position which shielded her left side from the entire company. At this moment I saw that her left arm was at her side, contrary to her usual practices. She then brought the pack of arist in her right hand down to her left, while the latter was still shielded; then immediately both hands were (Continued on page 441)

A the house . Ar Woorks Mrs Frapry De Prince & Mr Ingalls Prince # Bird a de Leanure r Carrington "Stonographe. ingum

I position at cretical manuel

Makism's working to

Makism's result position Treed table of stone

Mrs. M stands for the medium a traveling con-panion Mrs. Kirby and Mr. Woorts are members of Mrs. Wayburn a family and Mrs. Empey wa-her guest. Mr. Ingalls is a contributor to our col-umns and Mr. Junes a New York Times reporter. The other sitters need no introduction

The over sures need no introduction.

The arrangement of the group at the critical moment in the Bayside scance, when for the first time in four secsions the opportunity for substitution existed.

N October 16 there were produced for the Scientific American Investigating Committee, by the medium Mrs Y, five cards with "spirit messages," alleged to be precipitated upon them in coloring matter extracted by the psyche, operator from flowers and a gold bracelet. On critical examination, the Committee finds that these conds are not of the lost supplied by them for this scenes, but were brought in and substituted for such cords. This decision is based on the following considerations. I. The cords supplied for this stilling net 42 927 22 and 43 1/32 inches long. These on which the writing was produced were five unches long, the same uses as the cords supplied for a previous intring, some of which were

sing after that sitting

The cards on which the writing appears are of a distinctly grayer

II The cards on which the writing appears are of a custicity grayer color than those supplied by the Committee Committee the Committee the Committee of the Committee the Committee of the Committee the Committee of the Committee the Committe

by the Committee 1 he chance that the would occur, in accusan and my good faith, no men 170 influence.

V The cards on which the writing appears weigh, on the average,

V The cards on which the writing appears weigh, on the average,

O36 grants less than those supplied by the Committee, in spite of the fact that they must be weighted with the writing. The difference would be at least doubled if the could be arounded

VI The texture of the writine cards, as examined by an expert, is more mittald and less went than that of the cards supplied by the Committee

and has made affidavit that the cards which I sho

and mas made amount that the cards when I showed him as ours were actually of those supplied by him, while the five that carry the writing were not supplied by him, and are of allogether different riok. The case, strictly apaking, is complete with this showing, but there are other points of extreme interest In the first place, many readers will doubtless feel his ti coght to be explained how the medium could prac-

Our Abrams Investigation—III

Comments on Our First Test and a Look Ahead to Other Tests and Studies

· By Austin C. Lescarboura

Managing Editor, SCIENTIFIC AMERICAN, Se cretary to the Scientific American Abrame Investigation Com-



S WAB to be expected, we have heard from all parts of the country regarding the property of our first test of the electronic reactions diagnosis, which appeared in our townsher issue. The comments represent three distinct shades of opinion First, there are the orthodox medical men who, quite natur-

ally, are pleased with the negative results, according, there are the electronic practitioners who are obviously disappointed with our findings, but who are just as ready to offer reasons for the negative results, thirdly, there are the laymen who, in the capacity of find ar-biters in this matter, are glad that our investigation

It would be quite impossible to quote the various comments which have been received, but it is our inten-tion here to present in digested form the various shades of opinion and comment which have been presen

or opinion and comment which nave been presented.
When we first entered this Abrains electronic controversy, it was our original and superficial opinion that the subject matter could be readily dealt with.
The claims, fantastic as they might seen in the light of orthodox medicine, could readily be checked up so that a favorable or unfavorable decision would be arrived at in short order It also appeared to us that we were dealing with but one definite method of diag nosis and treatment, namely, the electronic reactions of Abrams—known as K. R. A., for short. This, of course, would make the matter relatively simple Instead, and much to our surprise, we have already learned that there are many variations of the electronic reactions diagnosis and treatment Abrams stunds

as the originator of this entire techn but there are many departures from his teachings. Here and there we find entirely different methods of harnessing the electronic reactions, so that it become true Abrams electronic reactions and those of other brands.

And so we hasten to reiterate at this time that the equipment and the methods employed by Dr X, who cooperated with us in our first test of the electronic reactions diagnosis, are not those employed and recommended by Dr Abrams. The and recommended by Dr Abrama. The air-column method of percussing, which we described at length in the report, is no longer employed by the Abrams prac-titioners who have better methods, so they claim, of detecting the electronic reactions of the human reagent. The equipment used for our first test was not manufactured by laboratories and individuals authorised by Dr.

Abrams, although, truth to tell, the equipment in ques-Aurama, attuouga, truth to tent, the equipment in ques-tion struck our critical eye as being of better workman-ship, so far as externals are concerned, than Abrams apparatus which we have seen elsewhere Now, then, we are confronted by a curious situation

We must make certain in every test that we are dealing with genuine Abrams equipment and technique, or with some other equipment and technique Dr Abrams win ground agrams equipment and technique, or with some other equipment and technique Dr Abrams binself has warned us not to confound his methods with these of others, and to bear in mind that there are over forty "bogus" electronic reactions devices on

The market.

To differentiate between the genuine Abrams article and others is not a difficult matter. But our obstacle takes the form of giving the electronic reactions diagnouts an unbiased and thorough test. If we are to listen to Ir Abrams and his immediate followers, we are told in so uncertain terms that Dr. Abrams himself. are told in no uncertain terms that Dr Abrams himself, and no one eis, should receive all our attestimes. We are even cautioned against making experiments with the including exponents of E. R. A. although we are entirely at liberty to get their wives and communic regarding at liberty to get their wives and communic regarding at liberty to get their wives and communic regarding our committee is invited to with U.P. Abrams at his clinic and laboratories in San Francisco. A visit to Dr Abrams and a rigid test of his technique abould form an important part of our investigation, if you will be a recognized Abrams practitioners. If for each single with recognized Abrams practitioners, if for he introducial never deals with the originator of this behalf of the control of the control

the important point. We mean to test the E. R. A. under real, practical, everyday conditions, so as to have a workshie decision with regard to the entire question, rather than a theoretical, unfinished, imperfact, and, to speak plainly, "staged" investigation which would leave the latty quite dissatished and completely at so.

We have received from Dr Abrams a list of recog-We have received aron of Altrains a loss of accep-nised E. R. A practitioners within ready reach of our investigating committee, and we shall make every effort to secure their cooperation in our work Altready, several of them have shown the kessest interest in our several of them have shown the keeper hatevar, in our work and a willingness to did not never year. At this writing we are arranging for a text in which a number of recognized Advanus practitioners will take part. A collection of pure gener cultures, pregards according to writing the control of the present cultures, pregards according to will be disagneed by these practitioners and their various findings checked up with our list of the cultures. This demonstration will be most interesting. We hope to have the report for our January issue. So much for the subtractes R. R. A practitioners.

So much for the authorized E R. A practitioners, But now we come to the real compileation. It seams perfected thing and that much remains to be learned indeed, almost weekly some new "rate" is discovered and some abortcut or butter way of disposing and the prevailing option. Dr. Alterns is by no means responsible for all this technique, for much of it has been contributed by his followers. Most of the K. R. rs adhere closely to the Abrams teachings, but

discoverios and possibilities of Dr Abrums thin Abrams himself. Indeed, we have been asked to devote the himself. Indeed, we have been asked to devote the which, we are assured, will give as positive results where Abrums himself would perhaps fall. Moch the seme may be said for the equipment the Moch the seme may be said for the equipment the put out by manufacturers of electronic equipment, the writers of which have displayed real art in impiring the reader's confidence in the abetrunic reactions on the cost hand, and then, by rabble symment, wringing over one hand, and then, by rabble symment, wringing to one hand, and then, by mobile argument, writingle over the reader to come particular kind of aganatius which gets results when the others full completely. We were amendant brilled when we received what appeared to report on electronic diagnosis and readment of dimense, written by a consulting electrical engineer. Full the page and the diagrams led us to believe that here, at size, was a surfacious report on the subject which would are also as the surface of the surface of the surface of the page and the diagrams led us to believe that here, at size, was a surface use possible to the surface page and the diagrams led us to believe that here, at size, was as arrived report on the subject which would be troubt tockniques, by giving as the subject which would have been appeared to the surface of the surface of the tocknique of Adrums, but that there is something in the teachings of Adrums, but that the originar apparatus now available which will give positive results. Subsequently, ys another mail, we recodive a apparatus now avaisable which will give positive results. Subsequently, by another mall, we receive a bulletin announcing NEW apparatus for electronic dis-nosis and treatment, in which all the former drawbacks and imperfections have been obviated and many novel nents have been made. Needless to say, this

s have been made. Needless to say, this bulletin comes from the same source as the report already mentioned. Hence we shall have to devote our atten-tion not only to Dr Abraus and his ič. R. A. workers, but to other electronic workers A workers, but to other electronic workers who claim to have something better than the original technique. Furthermore, we shall have to disrepard the personal equation in our investigation. Merely to ceratch the surface of the Abrama question soon discloses that there is little love lost between the various electronic practitioners, and that their references to one another are most uncomplimentary but at all the

in persect reciprose.

Returning to the comments on our first test, the R. R. A. and other electrodic practitioners seem agreed that Dr X did not know what he was doing. "Why report findings of from 49 ohms to 163 ohms of streptococcle infaction, when less than

sireprocectic infection, when less than can ever go?" asks an E. R. A. worker in criticising our test and our findings. Others have brought the same point to our attention. Our reply is that we did not determine these readings. They were given to us by Dr X binnes!, working at his rhecottats. It does seen, however, that due allowance must be made for the fact

Dr. X binnest, working at his rhocotatin. It does seem, however, that the sallowaten smale by made for the fact that Dr. X was working on pure perm cultures, include that Dr. X was working on pure perm cultures, include that Dr. X was working on pure perm cultures, include the control of th

A N investigation of the electronic reactions of Abrams and other electronic methods of diagnosis and treatment has been undertaken by the SCIENTIFIC AMERICAN. A committee of competent, unbiased, keenly interested scientists will formulate the various tests to be undertaken as well as pass upon the results obtained. The investigation is based primarily on obtaining first-hand data as the result of our own tests and observation. We are investigating the electronic technique as a whole, and not the individual practitioner. We invite the cooperation of everyone, in order that the true facts may be presented to the public.

> here and there an E. R. A. worker strikes out along new lines. In fact, some R. R. A. practitioners are frank to say that they have used Abrams' original teachings to become acquainted with the electronic reactions, and then have developed their own equip-ment and technique which, if we are to believe them, are far in advance of those of the originator

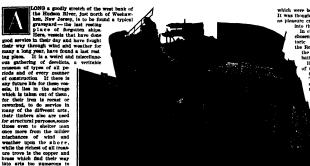
> Now the point is that these distinct variations from Now the point is that these distinct variations from the abrans technique cannot be ignored for a moment. While our investigation is termed an "abrama" investigation, it most develops into an investigation of the electronic reactions proper, taking in all manner of equipment and technique which still bear some sembance to the S. R. A. practitioners whom we have met the Some R. R. A. practitioners whom we have met the set of the S. R. A. practitioners whom we have met the set of the S. R. A. practitioners whom we have met the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom we have met the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners who are the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom the set of the S. R. A. Practitioners whom

> impressed us with the fact that they, rather than Dr. Abrams, can give us a convincing demonstration of the merits of the electronic reactions. They have told us that Dr. Abrams has discovered a wonderful thing, but that Dr. Abrama has discovered a wonderfert him, but that he has not developed it to the full. Idenaryhlo, that he has not developed it to the full. Idenaryhlo, truths and the original technique of Abrama, they have forged shead with their own egulgament and technique and have left Abrama soits dislance betind to sketyonic and have left Abrama soits dislance better to sketyonic man better than the state of the same and the same and have left abrama soits dislance better to sketyonic man better than the same and the same and the same while others still recain the right to use the B. R. Adeapanton, but are frank to state that their seekood senganton, but are frank to state that their seekood deviate sufficiently from those of Abrams to make their work that much better.

> Efforts have been made over and over again to its press us with the fact that these electronic reac workers are far better exponents of the fundam

The Last Harbor of Forgotten Ships

Where Old-Time Clipper and Modern Submarine Chaser Meet for the Attention of the Salvager



Remains of the historic old "Granite State," ready for the salvager The timbers in old ships such as this one find a variety of uses

ention. Perhaps the most appeal ing among these works are the fine sailing vessels which stand there, gaunt and stiff, like fine old aristocrats of a former day, with their graceful prows lifting high above the water With the coming

ships found a use, and from out of harbors here and there along the coast, came to do service as freight car-riers. Their period of service, however, was short, and at the close of the war many that were not sold abroad

at the close of the war many that were not sold abroad from their way to the graveyare.

Many types are included among those old satisface, along them are representatives of those Beautiful vessels, the clippers of the fittle and sixties, probably the most parcel merchant crut that were ever passed the presentation of the control of t

over here from across the river, after being burned at her dock, to be broken up free, have been done up for the copper, bram, etc., that was in her Subsequently, while being towed north for final breaking up. the "Granite State" caught fire again and went to the pre again and west to the bottom. This representative of the old three-deckers dated from the time of sail power and the smooth-bore. Not far from her stands what far from her stands what was once the flagship of the New York Yacht Club, the New York Yacht Club, the New York Yacht Club, the Conghiable, and seems to be a symbol of the familiar traged which made her owners wish arever to see her again. Then we hotice the old floating dry docks, dating from the New York Yacht Planyan cally innove how parmeble element or intelligence traffic, forms a conspicu part of the assumbled on. Here also are to be haven, some of

of them, date back simust to the opening of the Eric * rents to the radio transmitting station and in a similar of them, dute back almost to the opening of the Erric Canal Farther along the shore we see the "Hatterns, its name recalling the guleties of fifty years ago when she was the queen of river hosts and her decks, as she went up and down the quiet waters of the Husson, re-sounded with music and the shuffing steps of the dances went up and down the quiet waters of the Huston, re-sounded with music and the shuffing rieps of the dances popular in those days. Close by is another famous boat, the old excursion barro, the "Columbia," memor-able in the minds of the sporting fraterally frun the fact that here John L. Rullivan fought one of his famous battles.

Of course, the most striking group of vessels is the closely packed fleet of submarine chasers, sixty of

which were bought up after the war as a speculation It was thought that there would be a demand for them as pleasure craft, but very few have found their way into the partit clubs.

In closing it may be mentioned that the spot an enemy it mit be mentioned that the spot chosen for this graveyard of slips is itself his-toric. In the adjacent country campaigns of the Revolutionary War were conducted, and on the heights above, placards tell the stories of battles and skirmis

Here, too, there are thrilling memories f meetings between the white settlers and the Indians, and of deplorable massacres. The most mehan holy association of this mpot is the death of Alexander Hamilton, that organizing genius of our young de-mocracy. On the cliffs above he morracy On the cliffs above he fought a se-called duel with Aaron Burr and with his pistol in the air received the fatal bullet of that sinlater character of our early history.

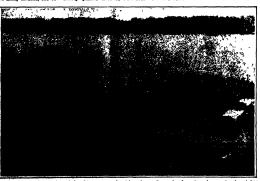
Copenhagen-Bornholm Wireless Telephone Service

THE island of Bornholm, I which so far enjoyed no telephone or telegraph com-Denmark, has just been con-nected with Copenhagen by a combination of radio and wired telephone systems, subscribers at both ends communicuting with one another without any special apparatus merely by calling up the exchange in the usual manner While the transmission of weak telephone cur-

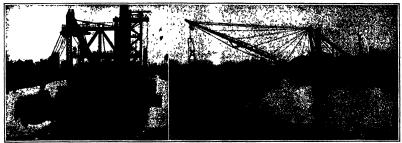
manner, the transfer of feeble receiving impulses to the telephone line at the receiving end entailed a suitable amplification by means of vacuum valves, special diffi-culties had to be overcome in insuring a duplex service. i.e., the possibility of simultaneous transmitting and receiving without any mutual interference and without one service to the other. The proper distribution of the speaking and listening currents is effected by means of a "distributor" working on the Wheatstone bridge

A new Lorenz-Poulsen transmitting station has been provided near Lyngby at the Copenlingen end an isolated loop arrial on a 25-meter must being used to receive the electric waves. The receiving plant is installed in the island of Amager to the southeast of the Danish capsoutheast of the Danish cap-ital At the Bornholm end, another Lorens-Poulsen transmitter has been in-stalled at Hammeren, in the northern angle of the island the receiver being situated near Rönne Harbor, on the western coast

tests between the Copen-ingen and Bornholm apparatus, on the one hand, and Berlin, on the other, were de previous to the op of the new service, thus dem onstrating its possibilities under conditions more exacting than the dally routing Other tests were made hetween Copenhagen and the States," whose captain, while on the high son remained in permanent telephone commu-nication with Copenhagen telephone subscribers, very much like our tests with the S S. "America."



General view of a section of the ship graveyard, with a large fleet of submarine chasers in the right fereground. The background is formed by the up-town section of Manhattan Island



Two famous dredges engaged in important work

Some Great Dredges Monster Grab-Buckets that are Able to take Fifty Tons of Mud and Rock at a Single Bite

By J. F. Springer

NCAVATING apparatus has been greatly developed because of the demands made by general construction in the United States and Europs particularly such great works as the Sucs Canal, the Chi-cago Drainage Canal and the Panama

Canal The steam showed is largely responsible for the success at Panana in cutting through the dividing ridge separating the occasion. The dredge cut the canal in the fresh and salt water sections and built a great part of the monster Gatun Dam. If a slide, big or little occurs, it is the dredge which is relied on to open

itthe occurs, it is the dredge which is relied on to open up the great waterway again.

All over the country, dredges are more or less in use. They float from point to point, and executes soft and hard material. On the Pannana Canal, though the log one server when its still going on Prom the canal prison itself, some \$713,130 cultic yards of earth and rock material were recursed in the flastel year enting June 80, 1820. All of this, in addition to suzillary work, as done by at hig dredges, there of them being of the dipper type and three of the bipseline section clear. The dipper dressips—the "Partials," Visinales," and the dipper type and the control of the dipper type an

when set with the opening up, to permit 34 stand, without undue crowding, upon a platform suspended inside the great open-ing The "Paraiso" was one day engaged in its work, the great hull, from which ing The "Partale" was one day engaged in its work, the great but, from which in its work the great but, from which donting quietly on the smooth water. The control of the partal shadows and the same a

\$0.44100 per cubic yard The sister dredges also did breat work, though at costs somewhat higher The pipe-line dredges are also big fellows and com-petent to the performance of severe service. Some may wender that so much work is going on at

Some may wender that so much work is going on at Punnam Part of the work consists of new construction and part is to be classed under "maintenance". As a matter of fact, the new construction amounts to only a small percentage of the whole. Upon July 1, 1920, therey per reminded to be taken out of the prism of the canal the very considerable amount of \$280,000 (ubic yards of earth and rock. This material may be classed as siltage, material from sildes, and original material. Really, the canal will never be done, even when the Really, the canal will never be done, even when there are no more sides and when all original material has been taken out and away. Gatun Lake, through which a very large part of the canal 'una, is the recipient to recential streams thus made tributary to the lake bring down naturally their quotas of material from their several watersheds. However, it will probably be some time before the last slide becomes a matter of history. As long as there is any real reason to fear to whether the side of be kept at a pretty high level

be not at a pretty night level.

Dipper dredges operate much after the manner of its regulation steam shovel. There is a great boom

which furnishes a fulcrum for the operation of the arm at one of whose ends the bucket is attached. A rope, secured to the bucket and passed over a wheel at the end of the boom and thence carried back to a drum on board the vessed, provides the means of swinging the disper-arm. The disper is continually open on the the dispersion. The dispersis continuing open on the side next the material to be secured. On the opposite side is a bottom blinged on the side next the arm. Ordinarily, the load, when severed, lies inside the bucket. It is dumped by releasing the binged bottom, where the material drops onto the pile or scow. The action is entirely different from that of the pipeline. action is entirely different from that of the pipe-line entition dredge in this case, the material is suched method and pipeline. By the use of relay pungs, the material, a pipe line. By the use of relay pungs, the material, together with a quantity of water, may be conveyed long distances and to elevated positions. In the order that the pipeline of the pipeline of the pipeline of the term atterial for Gattan Dam naturally had to be ele-vated. In certain comparatively recent work on the casal, the dredges were just about a mile distant from the outfall

the outfall

There are quite a number of varieties of dredges. On
the Pacific Coast, for example, recent years have seen
the introduction and use of hig clam-shell dredges. The
clams-shell excerving bucket has been found very
matrix of use of the control of the control of the
tenth of the control of the control of the
tenth of the control of the control of the
tenth of the control of the control of the
halves which open from and close upon
each other much as do the valves of a
clam. A good type of beciets will his late
to the control of the control of the control of the
exercise a good load. That is, they dig as
well as shored.

On the Sacramento River, overlain hig

well as abovel

On the Sacramento River, certain big
Gredges, as the "Neptune" and "Mara," have
been doing great service. Naturally, the
vessel must be a considerable sfall. It is
provided with as A frame or an equivalent
as a means of providing locations from
which a great boom may be operated. This

may have the sucremous length of which a great been may be operated. This boom may have the somemons length of 340 feet, and the bucket operated from its 340 feet, and the bucket operated from its colors and may have a capacity of 8 cubic the capacity of the three monater dispositions of the control of the capacity of the three monater dispositions with many capacity of the three monater dispositions with the capacity of the color of 340 feet has a reseal far broaded engithing possible with must discharge slosseby, as on to an attendant of the capacity of the color of the color of the color of the capacity of the color of the capacity of the capac



Dipper draigs of eight cubic yards capacity at work in the Chicago Drainage Canal

secured ("spoil") to either hank. It is said that canals having a width on the bottom of 500 feet have been constructed by this type of dredge without requiring any rehandling of the spoil.

reasurance of the spot.
Ordinarily, the boom is set with its outer end at the desired level and is then not lifted nor lowered while the bucket gets and discharges its load. The boom is, however, swum in a borisontal plane, thus enabling the hecket to carry the material to the shore and to return to the corresponding to the control of the corresponding to the control of the corresponding to the state of the control of the

the excavating point.

An interesting feature of these great dredges is the enormous boom having a length of 240 feet. Timber is used in the construction, and is in fact believed to be the

only mittable material for the severe service calling for great elasticity. This siss of boom is made up by using sections 110 feet long. The joint is made by using sections 110 feet long. The joint is made by using sections 110 feet long. The joint is made by searfing the and send then bottler them to centre the property of a calle within passes through saddles arranged on the ends of cross-arm struts. There is a certain amount of slippage permitted and this gives a degree of feetfallity Nunoscous guy run from the A-frame to large the properties of the section of the service and thus add to the power of resistance to loads at the end of the boom In fact, prior to the attribute of the bucket, the grays are so adjusted as to lift the far end a distance of 2 feet. This is to compensate more or less completely for the bottler, the grays are so adjusted as to lift the far end a distance of 2 feet. This is to compensate more or less completely for the bender of the properties of the compensating feature concerns the method of compensating for the dip of the hoom consequent on the list of the vessel when the boom with it is not all swrung. It has been found that the overhange of the A-frame has

An interesting feature concerns the method of composating for the dip of the horm exessepont on horpersisting for the dip of the horm exessepont on the properties of the control of the control of the conline of the control of the list is used any be utilized for the desired purpose. It is, however, amount to produce the best results, It is understood that it is possible so to put the one thing against the other with each particular dredge as to make it preticulate to write the loaded boom end in a substantially horizontal plane. The operation of tension of the control of the con



15-yard dipper dredge "Gamboa" at work on Cucuracha Siide, Panama Canal

operation of the two control cubies. A great variation in the positions of the cubies in required its order to control to the positions of the cubies in required its order to control cubic ways. In the carrier diverse, attained to each of the two sides of the A-frame down near the base. These sheaves, known as "sinter sheaves," were to provide alterna extron whenever possible. It was found, however, that does not more times during every cycle of operations, the cubic would cut across the flange of a provinent in Godign consists in the use of a single counterpolanced sheave which is so designed that it automaticity adjusts first! to any and all positions without inducing more than one bend in the cable "This transpiration in a considerable considerable considerables."

without inducing more than one hend in the cable. This change has resulted, it is underdood, in a considerable relation of the considerable relationship of the considerable relation of the considerable relationship of the considerable relationshin

That there must be nothing faully in the rigidity of the construction will perhaps be glimpsed when it is learned that such dredges as the "Neptune" and the "Mars" are operated 24 hours per day and that a cycle of operations is game through with in from 103 to 120 ecconds. The big dipper dredges at Panama are able to go through a cycle in much less time, when a great struggle was going on to beat the sildes, they were put upon a cycle-time of 45

895

The Lifting Lock

THERE is more than to one interesting variant upon the ordinary canal-lock. Along the line of the Old Morris and Essex Canal, for instance, which climbs the Jersey bills at numerous points, may still be seen the remains of the "canal rail-ways" by means of which these climbs were effected.

These are nothing more or the water and the water and the waterway, up which the bosts were hauled bodly on a wheeled carriage at the end of a cable Another, and water and the waterway in the water and water and the water and there are thought canada, but similar installations are found here and there throughout the world, and we have a fine recilection of hunter described one of them before.

dim recollection of having described one of them before.

In the case of Peterborough, the atream is a part of
time it is desired to have the way navigable for barge
of moderate size. There is a material descent at 1 Peterborough, one of the points of actual prowe development.

Instead of the ordinary lock, the bydraulic lift is onemarked of the ordinary lock, the bydraulic lift is onesufficiently large to accommodate any vessel which the
terms instal would accommodate if the beleage is to
be in the downward disvertion, the lift is raised to the
trapital waterway on this level, and like an ordinary
lock, constitutes in offect a continuation of this. The
table the property of the level, and like an ordinary
lock constitutes in offect a continuation of this
the between the river and the lift is opened, and
the standard of the gain continuation of this
the distinct and the gain closed. The lift is the
lowered to the lower level, where the gast at the other
lowered to the lower level, where the gast at the other

in the control of the

The Peterborough installation is believed to be the highest of the kind in the world. The lift which we illustrate seems to scale about 60 feet in height whom measured against the inen standing on the upper level. It raises or lowers a wessel in twelve minutes.



The Poterborough (Canada) lift-lock, combining the features of a lock and an elevator

Driving the Bomber

Latest Guns Make the Air Deadly at 20,000



MATTI B9 stand today no matter how excellent may be the new guns and other million a attrial developed by the Arms and Navs the question of whether the nath shall make and use them is decided

by the inexperienced layman Before these improved weapons can be built in numbers the mency for their construction must be appropriate and the selection of the selection and the appropriate a a wise constitutional provision it has the salious defect that due: lack of knowl edge or to mishformati n (matess is liable to withhold fund; where they are urganity needed or 1 grant them for ex-perimental devices which subsequently may to be taken some are always perfluent and they are arritations as to do, to we

ad they are particularly so teday in re gurd to the military value of tirplane bombing. The public is always attracted by the spectacular and unfor tunately the experimental bombing of battleships as carried out two years og and this year off the Virginia coast when several anch red battleships and cruisers were sunk has mide such an impression on the mi of these whe underlinke to write about Nave and milli lary matters that they have proclaimed the battle ship as already domed and the airplane as supreme. Why build a battleship cesting \$40,000,000 when an airplane costing the merest fraction of that success sink it with

There are two major follocies in talk of this kind lise the ignoring of the fact that the battleships at tacked were anchored the second that they were pro-vided with no means of defense whatsoever. The death

of these battleships was as certain as is the death of an ox when it is struck by the poleaxe of the butcher
Much has been made of the fact that a vast amount
of anti aircraft ammunition was expended in the world war to very little effect but the anti-air raft guns of 1914 to 1918 were feeble weapons c mpared with the anti aircraft artillers which has been developed since Laun airplanes during the we accustomed to fly over headile territory at low elevation with comparative luminally for the reason that the range of the anti alternat ratillery and its rapidity and accuracy of fire are fluided. Today the low warrier ones of thigh would be litterally sprayed with machine can builets and with a borrage of but sting shangard. Moreover, what is true of the land fighting of the future Moreover, what is true of the land fighting of the ruture is true also of fighting upon the seas The battleship will bristle with machine guns with a maximum vertical range of 1200 feet and with automatic guns firsh 1½ inch high explosive shells with a maximum range of 14000 feet. Ti rev inch guns have been developed by the army which me effective at 1000 feet and 47 inch has with a verified lange of 80000 feet. Lutherm re it must be remen level that the shells fr in these waspons thanks to tracer ammunition leave a slidble trail of smoke behind them and are capable of being brought to bear directly up a come air lanes up t mages of 7500 feet 14000 feet and a 1000 feet Now If in the bembing experiments off the Virginia coast effective life could be made only at elevations of from 3000 to 1888) feet and then only because there was no inter-

to High Altitudes Feet, and Dangerous at 30,000 Feet

have been done sown with ma high explosive

a specified object, such as a ship or a fort, has been greatly increased by the high altitudes at which the bombing craft will have to operate

bombing exact will have to operate

There are four new types of and-alrerent guas now
in process of development. The first of the new gues is
the control of the control of

deed of a settledbip. The Seculibre guide state of the settledbip. The Seculibre was entitled for the Seculibre was settled for the second gun under development is a fir mannerine gun fining high explosive shells with frame so delicately adjusced that the shells, while art to so delicately adjusced that the shells, while art to so delicately adjusced that the shells, while art to define the second second seculibre security of the second se

Tar to play this bose accurately as an airplans the pilot of which had the hardhood to come within its zone of operations than to train him to play the usual type of hose on the battleship s deck?) type of hose on the battleship s deck!)
The third are gum in the group is a 3 inch weapon.
The third are gum in the group is a 3 inch weapon.
The third are gum in the group is a 5 inch weapon.
We shall be shall

and mounts of this type are now under test at army priving grounds to sail increase. He is not 6.4 inch. Our No. 4 in the sail increase. He is not 6.4 inch. Our No. 4 inches the list of the sail of the control of the feet. His horisotated rampe is in proportion. He is to be mounted on a mobile carriage with full traverse and equipped for power loading and with an automatic breech block to speed up firing This gas also can be rived at an elevation of 50 dispress, or within 10 degrees

of straight over the gunner's head

The experts are working out a system of indirect
aiming superiments having shown that central control
firing is greatly superior to the old systems. Two types
of central studions are under development, either of
which will materially speed up aiming and firing



had the air been chine gun bullets shells and shrap

elevations of from

_1000 feet? We doubt if a hit would have been made Ganila render whenever a so-called massl or exper-milliars writer tells you that the battleship is doomed and that sirvarft are masters of the sea and shore and sky allke be so good as to remember the facts given also and cease either to be misled or worried by these wild and altogether unjustified statements that the bat



New 50 calibor water-cooled machine gun. Vertical range 9000 to 12,000 feet. Fires 500 shots a minute

tiethin is doomed and that all future attack and defens will take place in the air

will take place in the air in referring to the great sittinde to which said in referring to the great sitting to when it mids particu-larly the new weapons which have been developed by our foast Arillery, austisted by the Orchance Depart ment. The description of these gama, as given below rerais it will be seen a truly marriedous advance over the anti-six raft arillery of the way and it is certain that the difficulty of making direct this with bomies on

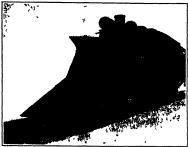


Left Gur 38-caliber anti-aircraft machine gun ready for action. Note the passenatio-tired wheels which make this gun en carries the ammunities. Right: The 68-inch anti-aircraft searchlight mounted on a light true

All Fixed for a Hard Winter

THAT present winters are as a class, A may different from those of olden days as falling that has been previy well extended in a falling that has been previy well extended in the past six years we have had extreme that the past six years we have had extreme that the past six years we have had extended to the past of the past six years and the past of the past six years and the past of the past six years and years of the ordinary paved road. With the advent of the winter of the ordinary paved road. With the advent of the winter of the ordinary paved road with the past six years and even of the ordinary large of the winter of the training of the parties and when the past six years and the past of the winter of the training of the winter of the ordinary large way to be held up by show it would not be extend to apply the past years of the past years were to be held up by show it would not be computed by the past years of the past years and is a fallacy that has been pretty well ex

because they were poorly equipped to d buttle with the forces of winter the rather amazing contraption pictured on the front of the locomotive herewith is the design which has been nitimutely worked out with this end in view Doubt that it



Novel snow plow, expected to be of unusual value in dealing with falls of moderate depth

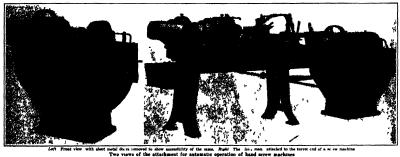
Bumping the Bumper

CONSIDER the bumper It tolks not nor helps the motor to spin yet every car owner knews that it is often a valu car owner knews that it is offen a valuable thin, to have ups n his machine. It is usually more bumping, than bumped against while in service but the opposite is true before a tested and approved tumper reaches your choses.

When the companies issuing automobile.

ecilisien insurance prepared to credit a reduction in the premium where bump-ers upproved by the Underwriters Labors tirks are used the task of testing such attachments a peared to be an easy mat ber of difficulties devel ped

It was found fr instance that it re-outed no less than 400 different shapes quired no tess than 400 different snapses materials and mitteds to must a single style of lumper upon the vari us makes in link is of passenger cars. The necessary fixtures or has dest thus presented a big prilen in themselves since many a higher like in themselves since manu-facturers have never apparently consid-ered the desirability of standardising precisions for langur mounting. The trusper tests have done matrated conclu-sively that truckers hading, successfully uren ne nake f ir triv full dismally



attached to the turret end of a se ew machine

would do as well as the powerful rotary in boring its way through extreme snow drifts is met by the statement that it is more is met by the statisment that it is more inuscidated; intraded for the ordinary more fall of a few inc hes or maybe a first or two which is to be expected continually throughout a fairly severe winter—that it aims to prevent that from developing into something that only rotaries, good luck such standards or more than the property of success

For the Hand Screw Machine

For the Hand Screw Machine
A DDITIONS and improvements to hand
I'ver machines have been in the
direction of improving the anabitate level
matter. How an Indianapolis manufacmatter has patient on the market as stated
mosto which does nothing to the inaction
The new attachment fully inserts the
name of 'the iron man 'which the maker
has bandered on it It consider really of
the completely sucheed for protection upon
which are flat came that operate crossheads by means of costnet with relieve
maker with This makes it possible forone such to operate an analyse of mechanic. The saching only in contrast, or reversed and altopped the back
off gad Ferming tools operated as often as desired



A bumper after being tested with a four-mile-per hour blow

The attachment of the iron man to a screw machine does not call for any alterations and in no way affects the availability of the machine f r use without the automatic attachment.

nijlied to a lossis of different design. The momentum with the lumpsers are, treated to make its model of the lumpsers are considered in the loss of the considered in the loss of the los

noming 1 to tooked on who an in the thing read in is but it fighthy to a constitution. The read is the second of the constitution of the constitut a 1000 pound car running t 8 miles an

The engineers believe that the practice of reversing actual conditions by having the theoretical fire-plug or telegraph pole the moving object while the automobile remains stul nary may account for the unexpected seriousness of the test results.

a Science

Gradenwitz SCIENTIFIC AMERICAN

Making Sport

Devices and Tests Which Determine

By Dr. Alfred Schulte, has installed at the



HHE sport in the curriculum of pre-war German public schools played only an un important part and was practically ex led from the university college, there has lately appeared among schoolboys and

undergraduates a remarkable much as everything in the Fatherland is sport, formerly looked upon as a rival of scientific pursuits, has lately been prod to the rank and dignity of a scien In fact, Berlin at present boasts two col-leges of sport where everything pertaining to gymnastic exercises and outdoor games as well as the behavior of the human body under the most varied conditions of physical activity, is investigated, practiced and taught in the same scientific spirit that is so characteristic of higher education at

One of the most important tasks to be solved in this connection is the ascertain-ing of individual fitness for each kind of

German space in the case of the footballer Other tests of a a special purely mental character comprise the testing of the venties as deeness of observation as well as the special type of attention and concentration power required in sports, not only for the subt of the sportsman but for umpire College of Sport in Berlin testing laboratory for in tions of this sort entrust care. His laboratory com

The football candidate's test. Two hinged doors are placed in front of the ball about to be kicked. After the ball is kicked, the angles of both deers are examined to determine if they are equal or, if not, how nearly accurate the kick was as regards direction

sport and the possibilities of the human organism with number of his own special apparatus for this purpose-regard to the developing of this fitness. One of the pio-while the medical advises specialising in sporting meers in the field of practical psychology, Dr. R. W. problems is mainly engaged in an investion of the

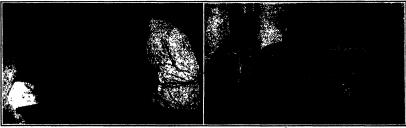
ing and individual temperament, the instate of the
deers are stated and backers of enablast, personal
sanurance and independence of outward
sanurance and independence of outward
sanurance and independence of outward
menter wishing to get an idea of the
would-be apportunisate first and thing, enumbrate, subordination and other psychic chemicatics are bound
to prove of condensulle importance in choosing a given

as well. The ascertaining of the individual as well. The ascertaining of the individual type of memory and association of ideas is of especial interest, the sportaman's intelligence often being of paramount importance to his individual finess. Judgment and discrimination, power of rapid combination and presence of mind, an increased adaptability and real ingenuity are among the qualities primarily required in the

the qualities primarily required in the efficient sportanian.

However, psychic investigation at Dr Schulte's laboratory la more searching still and even comprises an examination of feel ings and individual temperament, the in-

the Individual Fitness of Candidates



Left: The boxer's test, which consists of hitting the buffer plate with a series of even blown, the force of each blow being observed and recorded to determine and control. Right: Determining the sense of rhythm of an earmans. The observer sets up a given rhythm by means of a telegraph key, while the ear man endeavor to follow that rhythm as nearly as possible. A recording apparatus keeps track of the observer's rhythm and that of the earmann



Apparatus for testing courage or plain "grit" by

structure, growth and functioning of the organs, the practical psychologist has a still more functioning though incomparably more difficult, task to graph with, via, the searching of the sportsmain psychic behavior. The psychological diagnosis tries to ascertain, gage and uppreciate the various composite prochic characters and capacities, while practical psycholizerapy contains the laws according to white artifact expectation of the containing copies. utilized

utilised
The rule of the selection of the fit applies most strik-larly to sporting scivities, though there is a natural in fact, the legislate of the selection of the cubes to show the proper way and thus be saved a useless waste of energy and enhancem. After investigation, was waste of energy and enhancem. After investigation, or quired, for example, in footbell or in boxing or in sevent intervals, the sportmans-andidater's including increase and faculties are cheeked up with the requir-sidation. The various factors tested at Dr. Bedulie's absorator. The various factors tested at Dr. Bedulie's absorator.

The various factors tested at Dr Schulte's laboratory form a list too long to be enumerated. Some of the more important are an examination of the acuteness of more important are an examination or the accidence of vision and escape of proportion, the gauging of distances, the muscular sense and sense of strength in the case of the borse, the functor in litting capacity, speed gaging in the case of the tennis player, calmass and security in that of the gymmant, the sense of rhythin and cadence in the oursman, the gaging of combination in

schearer's rhythm and that of the examina branch of sporting activities. Extremely interesting and striking results are finally obtained by studying the individual for the striking results are finally obtained by studying the individual for the striking results are finally of decidents, security of the striking results are complicated and financial and the stated more or less in detail. Nor has Dr Schulte been afraid of tackling such a complicated and dangerous situations, personal courage and energy, to frigure, and training capacity, in their most varied forms.

As one of the typical instances of the highly varied activities of Dr Schulte's inhoratory of sports, there is active the striking of the schulter's inhoratory of sports, there is activities of Dr Schulte's inhoratory of sports, there is activities of Dr Schulte's inhoratory of sports, there is active the schulter of the schult is active of the schult sport, namely, hitting capacity and the sensitiveness of joints. The candidate is asked to itself the ball lying in front of him in a given, exactly-spectral direction, any deviation from which exactly-spectral direction, any defiation from which exactly-spectral direction, any deviation from which exactly-spectral direction, any difference exactly spectral to the schulter exhibits the service any foreign positivities in standard to gape the intensifiest of jettes in hording. The candidate is asked to perform against the butter pages of the asparatta, (deviag a (Openisord on pages 446))

A Milling-Machine Dynamometer

VARIOUS devices have been designed from time to time for determining the pressures exerted by a milling cutter on the various working parts of a mill milling currer on the various worsing parts of a min-ing machine, but up to the present time there has been no mechanism which could be relied upon to give accu-rate readings of these pressures, so that the designer of the milling machines as well as the designer of fixor the mining historicuses as well as the designer of fix-tures and milling cutters for use on them, have been very much in the dark. It has long been recognized that accurate knowledge in this regard would also be of material assistance to the designer of machine parts which are to be milled, because in the final analysis, the pressure of the cutter is first exerted on the piece

ine pressure of the cutter is first exerted on the piece itself and merely transmitted from it, first to the fixture and then to the milling machine.

Another element on which there is practically no exhauster element on which there is practically no exhauster element of the property o ing the vertical thrust, the horizontal thrust, and the longitudinal thrust, and thus determining the specific pressures exerted in these three directions.

combinations of feeds and speeds, the effi-ciency of the milling machine varies and it is therefore important to have means of de-termining the actual termining the actual cutter pressures, entirely independent of the efficiency of the machine or any part of its mechanism.

In order to attain this object, the dynamoneter shown in the accommender the state of the

companying illustrations was devised. This dy-namometer provides means for reading the pressures exerted on pressures exerted on any milling cutter while at work, in two direc-tions, the readings being taken direct from the dials shown. The ap-paratus consists of a working table which is working table which is supported by a base plate, which is in turn bolted to the table of the machine The ver-tical downward or upward pressure of the cutter is read direct from the left-hand dial The longitudinal pres-sure of the cutter is read direct from the right-hand dial Those are the pressures with which the designers and

which the designers and users of milling machines, as well as milling cutters, are most concerned. However, if it is desired also to obtain the crosswise pressure, that is, the pressure in obtain the crosswise pressure, that is, the pressure in time with the milling-machine arbor, as, for example, if it is desired to determine the end thrust pressure, of a spiral milling cutter or a face milling cutter, the dynamometer can be mounted crosswise on the table, and the pressure in question read from the right-hand

The work platen of the dynamometer is supported at each end by a wide plate fulcrum, their lower ends at each end by a wide plate fulcrum, their lower ends of the wertiesl ond on the platen to a hydraulic chamber placed centrally under the work table. This chamber is connected with the left hand gaze which is graduated by trial in terms of the wertical load in

pounds.

The horizontal load is transmitted through bars which are flexible vertically, to the crossbeed seen at the right in our larger plots. It is a substantial to the sight in our larger plots the byfraulic chamber seen between this crossbeed and the end of the main frams of the Stynamonster This chamber is consected to the sight-hand gauge by the pipe shown. The plate theirum quarrying the loads to the levers are see constructed as no be rigid against vertical and cross loads, but facilities to longitudinal toods, and

the bars to the crossheads are flexible to vertical leads so neither system interferes with the action of the

Heavy springs are used to put initial loads on each chamber so they will show loads in either direction Guards are provided so that any desired lubrication or flooding of the cutter may be used

or mooning of the cutter may be used. The dynamometer has the capacity to withstand loads of 25,000 pounds longitudinal, and also loads of 4000 pounds in the opposite direction, vertical down ward pressures of 10,000 pounds and upward pressures. of 7000 pounds.

The working surface of the working table is 16 inches long by 10 inches wide, and is provided with three T slots. The height of the working table above the bottom of the base is 8 inches. The total size of the base of the dynamometer is 35 inches long by 14 Inches wide

It is obvious that the dynamometer is extrem It is obvious that the dynamometer is extremely valuable for numufactures of both milling machines and milling cutters, as well as for shops where mill ing operations are studied and given proper attention (as automobile plants and experimental shops), for laboratories and shops of technical schools and col-leges, etc. Problems attending standardisation of maand cutters can be more readily solved with

nose-prints of all pedigree animals would therefore prove an effective safeguard against this fraud."

The author is carrying out a further series of experi-

ents to determine whether the patterns are permanent ad remain constant in their form over a long period in the growth of the unimal, and whether the differences are always as pronounced as in the case of these two

It is quite possible that the same method of identi-fication could also be applied to dogs, and if so, it would be a very simple method of establishing their

Trees and Climate

In every country a subtermion reservoir exists at agreater or less depth below the surface. It is the level of saturation whit, of course varies from time to time according to the rainfall. At the sea, it cointo time according to the ruinfull. At the seu, it colli-cides with the mean tide level, but it rises more and more on going inland, and it is the level to which wells must be sunk before water appears in them. It is caused by the rain which is usually said to run off to the extent of one-third, another third sinks in to form this reservoir and the remainder is lost in evaporation When following a river valley, one often notices a line of springs appearing at a certain level, this is when the valley has been cut down to below the sub-

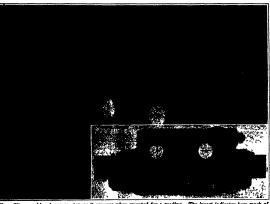
terraneun reservoir. which then forms a wet trough for it to run in When the reverse is the case, the river lones a great deal of its water by its perculating into the dry soil around and beneath it In the East this last is very com mon, so that rivers very often get smaller and smaller the further ther go, till at last they dry

up altogether

We see now that the denudation of trees has cumulative ili effects which tend to reduce the fertility of th try The reverse is also the case, a large growth of forests has accumu-lative good effects tend-ing greatly to increase the humidity of the air, the combility of the temperature, and the fertility of the region. The moisture in the atnosphere, largely sup-plied by leaves, has a very great, but often unnoticed, effect on a climate. The squeous vapor is imperviou heat rays, unless they come from a greatly heated source. In fact,

same way as glass, The heat rays from the sun pass freely through but when the same rays are re-flected back from the earth, the glass or the water flected back from the earth, the glass or the water vapor acts as a serven to them. The atmosphere in this case is just a blanket like the roof of a greenhouse, with all the benefits which naturally accrue from it. This is the mula reason who moist climates are so much more equable than dry ones. In a desert the day temperature often rises to 120 degrees or even 140 de-grees Fahrenheit in the shade, while at night it finsy ow the freezing point. In a moist climate in th same latitude the daily range will be perhaps from 80 to 85 degrees shade temperature in the day, and 65 to 70 degrees at night. The hotter the climate the more d are these effects. In the moist climate of Bengal, in the forested parts, the thermometer scarcely ever gal, in the forested paris, the thermometer scarcely over exactes 00 degrees in the sinch whitst at night it is rarely below 80 degrees. In the same intitude in Rik-amer Desert or in the Sahare, the temperatures have a diturnal range of perhaps 70 degrees or 30 degrees in-stend of 10 degrees, and this is entirely due to the absence of moisture in the six 11 follows, then, that the better the climits the more careful ann aboud be to preserve his trees, but unfortunately exactly the reof fuel, or shortness of pasture—ibstract from gricle

by Col. H de Il Haig in Discovery (British) for May.



eter, as it appears when mounted for a reading. The insert indicates how much of the upper picture comprises the dynamouseter itself The milling-machine dynamome

This instrument has proven extremely satisfactory and very sensitive under tests. Quite obviously its uses is not confined entirely to milling machines, but it is equally adaptable for making tests on planers, shapers, and with slight variations, defili presses.

Identifying Animals by Imprints

IN Discovery (British) for May, 1923 Mr C A.
Mitchell says "The most recent development of the
use of imprints from the ridges of the skin has been its extension to the identification of cows. It has long See those that the patterns of the there of lemons and the higher ages may be a couplex in their character as the human skin patterns, whereas the patterns of the ridges upon the ridges upon the ridges and the lower monkeys are much simpler in character. In the case of the ridges are much simpler in character. In the case of the ridges are much simpler in character in the lower less to look for any characteristic patterns in the hoofs, but, acting on a suggestion sent to me from lower and the ridges of the ridges and the ridges of the ridges been known that the patterns on the fingers of lemur

The Carlsbad Cave

Recently Explored Cave in New Mexico Which Rivals, If Not Excels, Mammoth Cave of Kentucky

By F Le Ros Thurmond

THE Constitute Mountains of New Mer. ico, twenty-four miles from Carlsbad and ten miles from the Texas line there is a cave in limestone of Carboniferous Age, rivaling, if not excelling, the Manunoth unique forms of its stalactites and stalagnites, and in the great dimensions of some of its

The cave in question is little the cave in question is little known, never having been fully nor officially explored, nor even exploited as a natural wonder. Its chief inter-est has been that it contained quan tities of guano from the excrement of buts, valuable as a fertilizar because of the phosphoric acid and nitrogen

it contains. The "But Cave," as it is known locally, was discovered in 1901 by J L.
White and Bigs Long, who were hunt
ing deer when they observed a great
swarm of bats coming out of a hole
to the head of a callow ray to the in the bed of a shallow ravine Descending by means of ropes, they found a gallery running for miles to the westward, and about two hundred feet deep, where the descent was made The floor was covered with blocks of limestone which had oughed from the celling Myriads of bats clung to the walls and ceiling. where they hibernated during the winter months, emerging only on summer evenings to feed on flying insects.

The cave was shortly afterwards exploited for the guano, the product being shipped to California, where it was manufactured into fertilizer, or applied in the natural state to the soil of orange and other fruit lands.

The writer, in company with Mr White, one of the discoverers, recently visited the cave and spent seven hours underground. This time, however, was sufficient visit only about a quarter of the known parts

of the cave

The cave is entered by means of a bucket attached
to a cable and operated by a holding engine. The
descent is 180 feet. The part of the
cave near the entrances—there are three of them in a half mile—is the oldest in point of development and decay because, being close to the sur face, the rock above is not thick mough to retain sufficient water con tinuously to cause the steady drip into the caverns below, but fragments of broken columns in the debris underfoot indicated that these chi hers were once adorned with many large stalactites and stalagmites be-fore crosion had removed the great earth movements had shaken them down with the masses of limestone which covered the floor to an un known depth

Traveling westward through a series of chamis is which widen and narrow, sometimes climbing or descending steeply for several hundred feet, w reached an estimated depth of 750 feet, about one and three-quarter miles from the portal

Here were a number of chambers known as "The King's Palace" Surely it was a palace fit to house a king of It was a palace it to house a king of the underworld! In one of these crys-tal laced chambers one might discover a sleeping princess enseeneed upon a jeweled couch. Other chambers of

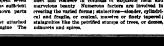
jeweled couch Other chambers of greater alse might have been plutonic council halis, grotesque thrones surrounded and canopled with crystal forms as curious and welfed as ever conceived by poet or drunkes brain. The imagination, unlabored, might discover gnouces and troils and all the quere little people who live in the sublight of poetic fancy.

Here was a study in the action of ground water in dissolving the calcium carbonate of the limestone and redepositing it in these grotesque and beautiful forms. This part of the care is alive and active today, water dripping from and slowly depositing a part of its bur-den upon the innumerable stuluctites, and a further quantity of it upon the stalagnites, which, through cen-



One of the many caverns of the Carlebed Cave, located near Carlebed, N. M., shewing the beautiful stalartites and stalarmites.

meet and coalesce in columns of exquisite form and meet and coalesce in columns or exquisite form and marvelous beauty. Numerous factors are involved in creating the varied forms; stainctives—slender, cylindri-cal and fragile, or conical, massive or finely tapered; stainguistes like the petrified stumps of trees, or domes,





Another view in the Carlabed Cave. One room alone in this cave is estimated one mile long and one-marter mile wide with ceiting 100 to 200 feet firth

A fascinating aspect of the pendent forms is the wonderful musical notes given out when skey are caused to vibrate Striking lightly with a broken fragment will produce notes of marvelous purity, notes as deficient out were as those of a bird, or deep and someone as the contract and sweet as those of a bird, or deep and someone.

Lack of time prevented further exploration. However, according to Mr. White, there is a chamber some interesturation of a mile to the westward, at handless the interest the interest to the same than the same time in the interest known chamber in any cave. There is also an underground stream and, seven miles from the portal, an about cliff. Beyond this, nothing is known. As far as the actual dimensions of the various chambers are concerned, present figures are tilt in more than more art figures are tilt in more than more

ent figures are little more than more or less careful guesses.

"How was this care formed?" a member of the party asked.
"Do you see that ready streak in the roof where it is low enough to be illuminated by the torchest?" replied the geologist, "There is your answer." the geologist. "There is your answer. That streak is the line of a fault Water charged with curbon dioxide has moved downward and along the plane of the fault, discoving and carrying the calcium carbonate of the

rying the calcium carbonate of the limestone with it.

"And did you notice before we en-tered that the portal was in the bed of a ravine or draw? That ravine is the surface expression of the fault, and, after having been formed by ero-sion, it facilitated the formation of

sion, it facilitated the formation of the cave by capturing the surface water, where it flowed parallel to and directly over the fault."

The importance of this cave as a natural curiosity has been discovered by the Department of the Interior, which is now engaged in surveying and manulus, with a view to constitute and mapping, with a view to creating it and an adjacent area a National Park for the enjoyment of the whole

Edison's First Incandescent Light

A Tite present time, according to a "History of the A Electric Light" issued by the Smithsonian Institution, there are 850,000,000 incandescent lamps in use in the United States and about an equal number in use in

when Eddson first began the study of the incan-descent light in 1878, there were sev-eral commercially established are light systems to use in the United light systems in the in the United States. All these systems operated on the "series" system, the only system for distributing electricity known at that time. In this system current gen-erated in the dynamo armature flowed for distributing electricity harom at that time. In this system current generated in the dynamo armature flowed through the field cells, not to continue the continue that a practical electric lighting system must be patterned effect gradient to be continued to the continue that a practical electric lighting system must be patterned effect gradient to the continue that a practical electric lighting system must be patterned effect gradient that the continue that a practical electric lighting system must be patterned effect gradient to the continue that the continue that a practical electric lighting with the patterned to the continue that the continue th

SCIENTIFIC AMERICAN

Tested for a Million Volts

LECTRICAL testing on a huge scale is provided for in the factory at Freiburg. Saxony, where porcelain insulators for the continuatal market are produced. for the content in across the promoted.

A gigantic experimenting stage has been erected, specially designed for the testing of the porcelains under voltages of a mil lion or more. An idea of the size of this testing-stage, as well as some notion of the magnitude of electric discharges at this high potential, may be got by looking for the man in our photograph.

A Gasoline Rail-Car of Power and Stability

MORE difficult than the problems pre-tile operating conditions on the Nevada, California and Oregon Ballway The track is of the narrow gage of three fo is of the narrow gage or three rock, which would make it seem almost inevitable that stability would suffer to some degree. The attitude ranges from 4500 to 5500 feet above sea level, at which the air is appre-ciably leaser in oxygen than in most places where automobiles do heavy duty But the vehicles illustrated herewith have been conspicuously successful under these conditions. On the fastest trip recorded, a

100-mile stretch was made at un aver miles per hour, negotiating grades as steep as 2½ per cent, with 28 passongers Speeds as high as 55 miles per hour have been attained. On the initial run of 520 miles the gasoline cars average 11 miles per gallon, and refill ing the radiator and crankcase called for the addi

ing the radiator and cramacase cance for the audition of only one quart of water and one pint of oil These cars are 22 feet long, over all, and eight feet high from rails to roof. They are operated, like any well conducted automobile, by a sin gie man, from the front end gre man, from the treat can They carry four-cylinder mo-tors, 4½-inch bore and six inch stroke The motor is placed behind the rear sixle, placed behind the rear axe, eliminating all revolving parts in front of that point, and enabling the cur to be hung very low—14 inches from top of rails to floor of Also, the noise and dirt of the motor are left behind on the right of way to a very large extent through this ion. The cur weight is 10,000 pounds. The care

are built by a commercial concern, and are available in even narrower gages than the one used on this line. In all sections of the country, the railroads are turning to the gasoline car as a country, the rainroads are turning to include the amount of meeting the problems of the short line and the line on which traffic is not heavy enough to support the conventional steam train. Gasoline-car manufacture will doubtless become a growing specialty in the pres-ence of this newly created demand



German plant for testing porcelain insulators at high voltages

To Prevent Lamp Thefts

RAILROAD companies and other large users of elec-tric light bulbs are up against the problem of preventing the bulbs from being carried off surreptitiously by persons who prefer to get their bulbs for home use in this way rather than pay for them. A writer in the Electric Railway Journal of June 15th, discu

of a lock socket. Lastly, it is possible to use a lamp of running voltage, which will thus be too high or too low for common use, hence there will be no temptation to steal it

One variation of the "different-socket" plan is to employ a socket with a left band thread Incidentally, this is the method used by the New York City Inter-borough Rapid Transit R R to prevent the 40-volt emergency lamps from being used in place of the regular 130-volt bulbs, the former, having left hand threads, will not fit any socket except those especially intended for them Another variation of this idea is the use of a lump with a bay-onet base, as sockets to fit such bases are practically unavailable to the general

However, probably the most effective and most practical plan so far tried has been that of the lock socket The lock socket is difficult (ulthough not impos-sible) to remove without the key Moreover the very fact that it is locked acts

One form has a "dog" which is pivoted so as to permit the lamp to be inserted without difficulty but which "bites" when on attempt is made to unscrew the hulb It is easily unlocked, however, with the proper key

The Brooklyn Rapid Transit Co has adopted a form of lock saket which has an interior shell that turns freely within the outer casing consequently the lamp cannot be unscrewed until the key is inserted to engage the slotted base and thus prevent rotation. As the socket simply turns the third is not tempted to apply brute force to the lump.

Retter "Cas"

SURVAY just made by A the Bureau of Mines shows that there has been an upward trend in the qual its of gasoline sold at curb in several well distributed cities of the United States. The "gas" vaporizes easier This is the quality the motorist most wants, especially in cool weather when the rhythmic rusping of the self starter is so per sistently heard Contrary to is little difference in actual power value between the low and high volatile gusolines, and this difference favors

the low volatile fuel. When one descends along the and tow volunte their wine one descends along the scale to keroseno the fuel value is higher than gosoline. However in common practice the gas of high volatility is more eagerly sought than the low, both for the reason that it enables easier starting and because in the

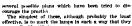
average motor it is vaporized better and the motor has a harder "kick". After all, it is not the theory but the kick of it that we wan



Narrow-gage rail-car whose gasoline-driven motor is located behind the rear axle

High-Altitude Tests Without Leaving the Ground

OUR cover this month shows the testing chamber for prospective aviators now in use at the French experiment station at Bourget. This chamber is intended to Bourget. This chamber is intended to show what will happen to the candidates respiration and to all his other anatomical functions at high stitudes. The atmosphere in the chamber is exhausted to a phere in the chamber is exhausted to upolat corresponding with the nititude for which the test is to be made. Every provision is made for effective use of the apparatus. Thus, while there is nativally no escape for the unknapsy candidate until the test is completed, it is recognised that the examining dector himself may be less effects, under high-nitistic conditions than normally. The matter of pressure is per-haps not so serious under this head, but haps not no serious under this need, our that of expyen is; so the doctor wears an oxygin mask that insures his normal re-printion. All the controls for the appar-atus any in duplicate, one set being inside the just chamber and one outside, so the the sattire operation of the test may be within or from without.



are easily identified Another plan is to use a base that will not fit a standard fixture. A third expedient is the employment



Better type of portable grandstand, developed by New York's municipal ongir

Portable Grandstand of Structural

A NFW portable grandstand has re-cently been developed by the Depart-ment of Plants and Structures of New hork (ity The framework of the stand is built of structural steel units 5 feet long and 1 foot 5 inches high. The units are assembled to form the risers of the stand Car holts are used to fasten the sections together Longitudinal sway braces of 14 inches by 14 inches by 14 inches angle iron are boited in between opposite pan is of adjoining risers as the stand is erected The risers are spaced 5 feet apart. The flooring of the stand is made up in sections I foot 8 inches wide and 10 feet long secured to the risers by clins which exten under the flange of the top angles of the riser frames. The seats are supported on pipe pedestals bolted to the floor sections. The method of construction eliminates a great deal of the liability of the stands to collapse, and provides chain seats separate from the platform. Erection and demolition are very much more expeditious than with the more familiar type of portable stand

The "Horse-Hair Snake"

An Account of the Extraordinary Life History of One of Our Common Worms

By Leon Augustus Hausman, Ph.D istant Professor of Zoology, Rutgers College

ITH the inquiries of modern blological science into the life-history of the "horsescience into the life-history of the "horse-hair make," another of those pleasing fancies of our childhood io, that horse hairs placed in a tub of water would turn into snakes, is forced to take its place in the fabluous. In this instance, however,

the realm of the rabulous. In this instance, sowever, science supplies us with a story concerning the life of the horse-hair snake far more extraordinary than that of which her researches have deprived us. The belief in the transmutation of inanimate objects

are owner in the transmittation or insultants objects into animate beings is as old as the human race. The belief in the transmitation of horse hairs linto animate is perhips the last to loss its hold. We find insultant of the horse-hair sanks in Shakespeare's "Antony and Cleopatra," Act 1, Scene 2.

"Much is breeding, Which like the courser's hair, hath yet but life And not a serpent's poison"

Sir Thomas Browne (1605-1682) in his celebrated "Pseudodoxia Epidemica," or Vulgar Errors, of his time, does not list this notion as erroneous, and since we may not suppose that so scholarly and singularly scute a collector of contemporaneous superstitions and legends was ignorant of the belief in this transmutation, we was ignorant or the belief in this fransmutation, we may infer that he also gave it acceptance. In view of the surprisingly intricate life history of the horse-hair snake it is not surprising that the belief in its miracu-lous metamorphosis from a horse hair has lasted well down into the twentieth century, and still persists in remote rural districts, and among children, to the pres-

The hair snakes, or hair worms, as they sh more properly termed, belong to the Family Gordidae, and the Genus Gordius, a group of animals placed very low down, in the ascending scale of animal life, or to he precise, between the Flatworms (of which the liver flukes and tape-worms are representatives) and the Starfishes. Sea Urchins, etc. They are not as formerly supposed, at all ailled to the higher worm forms, such as the common earthworm. The hair worms resemble



Fig 2—Mass of Gordius twining together in a typi-cal "Gordian Knot" amid water plants

nothing so much as animated horse hairs (Fig. 2.) nothing so much as animated norse nairs (sq. 2. They are sheder black, brownish or yellowish forms, from three inches to a foot in length, and slightly tupered at either end. Hondside ditches, pools, old watering troughs, and the shallow edges of small lakes and pends are their favorite habitats (Fig. 1) They seldon inhabit running streams. When active they are engaged, usually, in making their way slowly and apparengages, usually, in making their was sever by a languid undulatory motion of the slender body, or writhing about among submerged vegetation. Frequently ing about among submerged vegetation. Frequently many individuals may be found intricately motted and twisted together into a ball, sometimes to the number of a hundred or more, which being reminiscent of the fumous Gordian knot of Alexander the Great, has given the family its name Great numbers of Gordian worms the family its name. Great numbers of Gordian worms often appear suddenly in pools and ditches which just before, were apparently free from them, and following such appearances tales have sprung up attributing their presence to a rain of worms.

The female Gordina distinguished from the male by her auminate, instead of bifurcated tall, after fertili-

zation deposits her very minute eggs (which are sheathed in a long delicate gelatinous strand resembling a sewing thread) on the stems and leaves of submerged aquatic plants (Fig. 3) Before fertilization both seven are round, but become flattened after the loss of the genital

After about four weeks there de velops from each egg a minute have, about 1/450 of an inch in length and vastly unlike the parent, having a segmented body, and bearing on the head a formidable protrusible bor-

ing apparatus consisting of sliff chitinous rods. About the base of the boring proboscis is grouped a series of tubercies each bearing a decurved spine. This creature



-Predaceous ground beetle (Harpalus), within se body the Gordius young grows to m

swims about setting in the water for a short time, and then bosen its way time the sett parts of the opportunity of any of the setting of the setting of the setting of the setting the bumph of some cerument Mayfly (Fig. 5). Within the body of the young Mayfly the best of the setting of the setting setting the supple of the young Mayfly the best of the setting setting sett as this stage is seven the loopy of its first book, in a rather dramatic manner, and takes up the schience in the body of its second host. This second host is often the cumuon Herpalus bette (by 6), and the transferrence of hosts comes about as the result of the dewuring of the first host by the second! Within the body thesure of the Harpalus

beetle the young hair worm completes its growth, and later emerges and escapes into the water in the form in which we are accustomed see it.

tudes in the life of the hair worm I pon the emergence of the larva from the egg it must first escape the devour ing maws of numerous fishes, and the gullets of a aquatic life. Its first host, the Mayfly or other nymph, must then be stranded upon must then be stranged upon dry land (commonly by the drying up of the pool), and next must full a prey to a hungry Harpalus beetls. The hair worm must, in its tran-sition from Mayfly to beetle, evade the cutting mandible of the latter, and be lodged unbitten, within its stomach. Upon arriving at maturity within the body timuses of



Fig. 1-Roadside ditches, a typical

must trust to luck, of a seemingly most capricious sort, to be carried into the immediate vicinity of water. Without the close proximity of water, without the case proximity of water, upon its emergence from the Harpelus, it would die at once Only those worms whose hosts full into the water or are carried away by floods, probably ever arrive at

full maturity

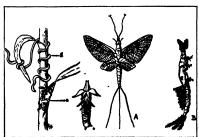
It will be seen that the chances of the particular sequence of circum-stances favoring the growth of any individual larva into a mature bair worm must be very meager indec worm must be very meager museu, and only a very minute proportion of hair worm larvae probably ever complete their life cycle Indeed, if we contemplate the dangers of destruction which the hair worm must be contemplated to the contemplate the dangers of destruction which the hair worm must avoid on its journey from youth to

avoid on its journey from youth to maturity its sense truly mirrections that any aboutd be able to make the jumped of all plants and the production. Only the most important of the dangers of destruction are here listed, there must be many more of which we have little knowledge. If may wickestudes in the life of the last woman to the many more of which we have little knowledge. If may wickestudes in the life of the last woman that there has come about a very interesting and unusual functional adaptation of the gentinels, whereby the worms are able to reproduce themselves before they become fully addit vision which nature him under as a counterchance to the great mortality of the high worm, is the remarkable the great mortality of the hair worm, is the remarkable ability in egg production. It has been estimated that as many as six million eggs can be laid by a female in one

seemen in the server feed upon the faity portions of the Mouter first roots, the doubt take to froot, and the doubt lake to froot, and the doubt late for feed and to deed, can take noos, for the mouth is functionises and is stopped by a culticular plug. Thus the adult life is merely a short period for matting and egg laying, and as an an internal parasite. From one to five individuals have been found in some linects, and during the last targes of their extinence as internal parasites be worms stages of treat extractions as the treat parameters for working may be colled up among the viscera of their hosts, and may even extend through the thorax and up into the head! The weight of the worms is often greater than the combined weight of all the internal organs of

the host!

Hair worms have also been found in the bodies of crickets and grasshoppers, forms which feed upon vegetation. In such cases the hair worms may have become promuturely freed from the bodies of their hosts by the death and disintegration of the latter, and consumed death and disintegration of the latter, and consumer with the folings on which they may have failer. The presence of heir worms, likewise, within the bodies of smalls, of the higher vertebrates, and even of man, is probably also to be neerlibed to necidental ingestion. Much investigational work still remains to be done in this fascinating little corner of biological research



Figs. 2, 4, and 5-Female Gordins (wining about the stem of a water plant and ng oggs. g: Goodine; et oggs. The selait A and the young or nymph B common Mayfly. It is within the body of the latter that the free-swin-ming layrs of Gordine nesses the entry stages of its Rie

Where Bridges Are Built in the Dead of Winter

THE Tennas Blvw Bridge, recently completed as the Inst. link in the Government's Alnaka Railroad, is usique in several respect. Measuring 700 feet from just to pier, it is the second tongest single-span railroad Louis, Approximately fifty miles from Pairbanks, the "Golden Heart" of Alnaka, it is the furthest north of big bridges. It was constructed in the dend or winter, with a temperature running for days at a time between 50 and 50 decrees below zero.

The second responsible of the second responsible of the control of the c

stee on a standard-spase track from Seward, an all pea-open seapers, to Patishanka on two-day, sil-day light scheduls. Hefore the bridge was completed, narrow age was used from the morth band to the Thamas drive-age was not been the morth band of the Thamas drive-soril bank of the river. Coosing of the river at Senana was made in summer by two ferryboats, the "Midnight Sun" and the "Mateinanka" in winter, when the less that there trues to a thickness of three to four feet, a narrow-gage track was laid on the ice and trains from the north side were brought across the river to meet the standard-gage trains on the south side. As the time for the spring breakup approached, the tre

were taken up and dog teams and sieds were used to transport freight and passengers over the crossing Erection of the main truss took place during the cold art weather in Alonda when the characteristics. est weather in Alaska, when, for short periods of time. the temperature drops us low as 50 or 60 degrees below zero. As the ice goes out of the Tanana river not earlier than May 12th, if the bridge were built

during the summer it would be some time in June before falsework could be estab-lished across the river, which would leave but a three months period before the run" in the full of the year. In addition, falsework would be endungered during the summer months should one of the hig floods take place. These occur frequently, carrying driftwood as large as full sized green cottonwood trees, with roots and branches intact, which have been savely a way by the flood in the process of bank croston. As the formation of solid toe usually is complete by the end of Cetoler and It seemed in the process of the savel of the conand it remains in place until May this six-month period was selected in which to ct the bridge and remove the false

The bridge was built at a cost of \$1,084 412 42, including the cost of changing the line of approach and fransportation of material. This is approximately \$200 000

less than the initial estimate length end to end of steel is 1302 feet, and the total length from the south end of timber structure to the face of the parapet of the north abutment is 4183 feet The bridge has a clearance of 47 feet above mean su rise bridge has a crearance of at teet move mean summer high water, which is ample for river steamers designed to proceed beyond Nenana to the upper river The stagle span of 700 feet, crossing the river from shore to shore, makes the bridge oblivious to any ice movement in the spring breakups.

Nenana, the townsite at which the bridge is located,

is a transfer point for shipments down the Tanana and Yukon rivers, and the Alaska Railroad has established



Fairbanks, the interior ter minus of the railroad and the center of lode and placer gold mining, is now in al most daily communication with the outside world Prior to the advent of the railroad it had to depend on dog sleds in winter and the less uncertain river boats in the summer



The three-foot concrete footings on which rest the expansion seams

The Largest Swimming Pool for Ten Thousand Swimmers

THE largest swimming tank in the world man jumber been completed in San Francisco as an integral part of the great park and playground program planned for the great park and programs 1000 feet in longith this city It is of reinforced concrete, 1000 feet in length and 100 feet wide except for a center portion which measures 150 feet across. Accommodating 10 000 swim-mers, it cost approximately \$80 000. The tank is located about three miles south of the Cliff House and about 150 cards from the ocean. The fact that ocean water is to be used in the pool, with its salt-water content,

growth of algae The walls are divided into 60-foot section



showing the fle w of grou

has necessitated many special features of construction. Excavations for the tank were made entirely in sand bight inch drain tiles were placed below the bottom raignt men drain tiles were panced networ the notion of the tank for the purpose of taking care of the hydrostatic pressure. These tiles drain into three freshwater wells, from which the water is pumped by electrically driven pumps and used for irrigating the municipal golf grounds about a mile and a half distant. The hydrostatic pressure is very great, as the level of the ground water is the same as that of the salt water in the pool If provision had not been made for pumping this fresh water from under and around the pool, the

> upward when the pool was The bottom of the tank 18 interlaced with expansion seams running longitudinally and transversely the long tudinal seams being 42 feet apart These expansion poort seams rest on five-inch reinforced concrete footings, three feet wide This footing has been given sidewalk finish and painted with coal tur to permit a bond befooting, thereby making ex-pansion possible without dis-ruption of either floor alab or footing. The expansion joints are calked with oneinch spun cakum, and the remen spun cakum, and the re-mainder of the seam poured with plastic asphaltic ce-ment To the concrete mix-ture was added hydrated lime (equal to 5 per cent of

concrete bottom would bulge

the weight of the cement) as an integral waterproofing of the mass concrete

The floor slab is five inches thick-41/4 inches structraily and one-half inch cement fluids on the finder traily and one-half inch cement fluids on the finder The cament finish was made by using a 1 2 mix Port land cement mortar, to which was added for each sack of cement five pounds of a waterproofing compound. The entire inner surface was finished with this mixture to overcome the chemical action of the sait water on the concrete and to give a smooth and even finish to the interior of the tank, thereby preventing possible

points there are expansion joints consist ing of wedge-shaped joints, forming a key which interlocks the two wall sections, The seam is composed of five strips of ex punsion stams and two 4% inch 13-gage copper sheets, put in to eliminate any pos-sible chance of the penetration of sait water from the pool into or through the concrete, and also to prevent ground water from entering into the concrete at the

feints. The swimming pool is filled with water pumped by a 12 inch centrifugal pump with a capacity of 5,000 gallons of water per minute. The water is pumped through a 16-inch steel pipeline 750 feet. in length extending 200 feet beyond the tide kvel and resting on a conpler thus assuring clean ocean water at all nes The tank is drained by gravity water passing out through the fil-inch steel pipe. However five fest of the 14-foot diving pit will be drained by a special

foot diving pit will be drained by a special sail water pump (as the diving pit is below the level of the sea) thus making a total of sky pumps that will be necessary to operate the pool The swimming tank will hold 0,300,000 gal-

Nature May Have Something Else Up Her Sleeve!

O'll wells, which as all the world knows, product O crude oil—and some of them a very low grade of crude at that—can produce something else At least, one well can, and is doing it steadily day

At least, one well can, and as doing it steading any by day. That is a well conted on Swaggart farm, a mile cast of Deer Creek Grant County northern Olda houn. This well is making about 1500 gallons of purhigh gravity gasoline testing 70 gravity, every day at light gravity gusonine testing to gravity, every day at 4800 feet. The owner of this will have fisher the oppor-tualty to tank the daily production and part it on the market at 10 cents a gailed. It is being sold to sesses of Great County track and fouring our owners, who formed a witting list soon after the well started making mosoline

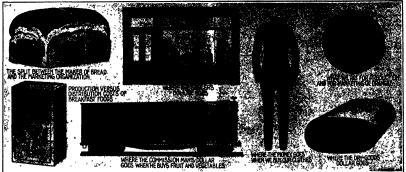
Natural gosoline is not unknown to the oil industryin fact, what is known as natural or casing head gaso-line is an important end of the oil business. However in this case the gusoline flows from the well and is not recovered or collected from the gas flow as is the c with ordinary casing head gasoline,

Geologista differ as regards geological conditions re-sponsible for the gasoline flow, except to declare that

conditions underground must have been such as to perform in a certain manner the refining process which man ordinarily uses to extract gasoline from crude oil At any rate, the well owner and the public which buys as my rate, the well owner and the public which buys the gmoline have reduced the complicated oil business to a simple thing in this case, whereby the production redunar, transportation and marketin, of gasoline are completed practically in one operation. No other wells of the Deer Creek field produce other than a fairty good quality of crude oil.



as River railroad bridge in Alaska, of a single span to make it asfe and fresheta, and built during the winter while the river was heavily freeze over



Graphical display of the way in which the dollar with which certain commodities are bought is split between producer, carrier and distributor

The Science of Distribution

An Authoritative Survey of the Devious Channels that Lead from Producer to Consumer



HEN our grandfathers were homespun clothes, raised most of the food they are and chopped the wood for their home fires, the cost of distributing the essential comnodities was practically nil. But

modities was practically all. But

Cities grow and became the market
places of agriculture Inventive gestias perfected ma

thuse to relieve more and more hand labor and to
produce goods in greater volume. Working days became

greater Minister and the control of the control of the control

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Transcription of the transportation and storage of food products and changed the living habits of the Nation. Fruits, vegetables and fresh means were transported to distant markets, the production of the transportation of instant markets, the production of the saming centers and ceiva of seasonal production were offered to consomers throughout the greater portion of the year. The communer cuine to accept unusual service and convolutes as a matter of course and convolutes as a matter of course and convolutes as a matter of course and the development of the production were additional people into the artivities of distribution because the determining futures in the excellence of service production of the pro

The above is not the work of an imaginative write. The above is not the work of an imaginative write, but is quoted from the report of a Congressional coin mission. This "finite Commission on Agricultural in quiry" has just completed the most remarkable of ment of the kind ever compiled Congress in the role of selectific investigator is at least something of a navely that this report assumes the dignity of Belesce noth

Ing teas.

For the first time it hays before us accurate figures and facts on the cost of producing and distributing a revenue may first the examination we have come to regard sound findancies on with mosted questions as "the high cost of livina" and "profiteering" and, as might be expected, the average conceptions on these questions are from anything warranted by the facts. For the first time was are given distributions are given the conceptions are the conceptions are part of the contract of the contrac

same methods used by the bridge builder for determining the structure of a truss or the size of the foundation

This knowledge has been gained with the most paties taking cure. When the committee was appointed, with Representative Kidney Anderson of Minnesota as chairman, it was instructed to investigate "the present of different agriculture, the cause of the difference between the prives of agriculture, the cause of the difference between the privace of agriculture, the cause of the difference was the privace of agriculture, the cause of the difference was the constraint of the privace of other products, and the marketing and transportation facilities of the country. Similar investigations have been ordered before, they have come ruther to be expected as a graveful gesture on the part of Coagress, even though tay mean little or arothing but this commission was

The first difficult encountered was the rather sagtling discovery that "there were practically no randomental data of a government or public character with respect to marketing and distribution, and it was there for necessary for the Commission to undertake a pioneering effort to secure from original sources the basic facts upon which a consideration of the problems of

accus uses a consideration or problems of with a series and to accurate the constraint of the trades affected the consideration of the Con

the trades. For instance, the Commission set up a retail general committee, a food insurfacturers' committee and similar committees in the 'neede scelling in dry With the assistance of these committees, questionnaires were worked out, designing to reflect, over a period of versa beginning with 1938 and ending with 1821, the actual price ranges of representative commodible reflected the portion of the consumer's dollar taken by each distributor, manufacturer or producer in this way, it was possible to chevit the figures submitted in the questionnaires of a given trade with the figures are committed by other factors in a chain of distributor, taken the consumer's committee of the consumer's the manufacturers of the consumer's description of the consumer's committee of the consumer's committee that the consumer is the consumer's consumer to the manufacturers of the consumer's consumer to the consumer's taken of the consumer to the consumer to the consumer's contained through the questionnaires. If fires thousand questionnaires were sent out and returned, covering a total of more than 200 commodities.

A single instance will illustrate the effort that went into the report. The committee on department stores, at its own expense, restrict own focus of a New York skyseraper and installed there a large force of accountaints and assistants, who worked steadily for some mouths assembling and condensing the facts about department.

stores The final result was a table of figures, which occupies just one page of the voluntinous report. And yet that table contains facts which never before were available, which were invaluable in reaching a final conclusion.

And what of the facts as finally adduced? Are they worth all of this trouble? Is there really anything wong with our system of distribution? If so, what is it, and is there a remedy?

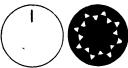
it, and is there a remedy?

The facts show unspectionably what we have only
suminded before that in many details our system of
suminded before that in many details our system of
the property of the state of the state of the state
before the state of the state of the state of the state
linked States in 1921, only about fifty cents represent
the actual cost of the brend, based ready for your table
The other half of the ultimate cost represents what was
greatly as the state of the state of the state of the state
of the state of the state of the state of the state of the state
of each dollar you spent for rolled outs in 1921 only
occusts went to the maker for his completed, board

Of each dollar you speat for rolled oats in 1921 only 30 cents went to the maker for his completed, board product. It took 70 cents to transport and seil the oats to you A dollar's worth of oranges cost only 41 cents to produce and harvever each for market Of each dol in you spent for richtee, 31 cents went for the cost of the young that the contract of the selling the doubling to you for every dollar spent for shore, 28 cents went for distribution

The freight bill on a curbod of cubbags shipped from Excus to the bill workern narrisks was about at times as much as the original yales of the cubbage in Texas. Most of the ratios and vegetable from Culifornia, consumed in the Bost in such large quantifies, incur freight with the Bost in the bost in which large quantifies, incur freight and the same of the wholesale to be same of the same of the wholesale in the same of the same of the wholesale same of the same of the wholesale same of the same of the same of the same of the wholesale same of the sam

about on per cent when the per control per cent for mischancous handling charges and about per cent for mischancous handling charges and about large control per cent for mischance in a large charge control per cent for mischance in a large charge control per cent for mischance in a definite trend toward maniler solution. Indeed, during the toward maniler solution. Indeed, during the toward maniler and maniler profits. Indeed, during the profit to the manufactures on channed milk was been profit to the manufactures on channed milk was been profit to the manufactures of the minerate thread in the per cent. In 1916 the profit was a fraction of 1 per cent, in 1906 the industry thereof a lous of 2.1 per cent. In 1916 the profits in 1921 were about 4 per cent. Consideration in 1922 the profit in 1922 the per cent. Consideration in 1922 the profit in 1922 the per cent. Consideration in 1922 the profit in 1922 the per cent.



The mounting of the neon tube on the disk (left), and the visible indication of the wave-form of the current supply that is secured on rotation

Recording Alternating Current Wave Forms A il is well known, the recording of wave forms of A alternating current supplies is in these days an important process to the electrical engineer Various types of oscillographs have been devised, and applied for the purpose, but all are relatively expensive and complex pieces of apparatus. On the occasion of a visit compace passes or apparatus. On the occasion of a visit to like recently opened research laboratory at Wembley, Ragisand, a new and very simple apparatus for tracing wave forms was shown. The apparatus is based on the use of the new discharge lamps containing neon gas. Under certain circumstances when the electrodes are in of straight wires the length of the wire covthe form of straight wires the length of the wire con-end with imminest give in propertional to the current with the strain of the strain of the strain of the in the tube is proportional to the voltage applied. As-cordingly, if the tube is mounted radially on the cir-cumference of a rapidly rotated dile one sees the wave being formed round the sedge of the disc. The accus-panyling diagrammatic sketch shows the position of the tybe and the resultant effect on rotation.

Amateur Photomicrography by Means of a Microscope and Hand Camera

microscope and mand camers

PHOTOGRAPHY through the microscope is at presest an art of the professional world only it is seldom heard of among musteurs, and yet such photography is one of the best instances in which the ordinary
camera can be supjected in exceptional work. With a
little care a stock camera and a microscope will give remarkable results, providing that sharply defined sub-jects are used.

neces are used.

The camera should be supported firmly, its iens resting on the eyeplece of the microscope, so that the film
is parallel to the object to be photographed. It is well
to wrap thriful shout the connection of the leus and
eyeplece to ground possible interference by light

eyepiece to avoid possible interference by light Successful results were obtained from a standard make of camera which takes pictures three and one-half by four and one-half inches. It has an anastiguatic less and an ordinary timer The focal length of the



An advantageous arrangement of the apparatus for

lens is six and one-half inches. The microscope used had objectives of four and sixteen millimeters, and a 7.5 eyepiece, giving magnification between one hundred fifty and three hundred lifty diameters.

and three hundred fifty diameters.

Lighting is the most important consideration of actual
picture taking Experiments proved that the best pictures were produced by intense sunlight (more powerful than is comfortable for the eye) directed on the slide by the concave mirror of the microscope. Owing to the fact that the light rays are tempered by both the tenses of the camera and the microscope, the film is not us violently affected as might be supposed. The direct sunlight enables the operator to take sunpelosts instead of time exposures, thus eliminating failures due vibration, movement of the camera or living subjects such as animalcules and diatoms. Of course, opaque subjects require longer exposures and a light thrown on them from above, but for ordinary objects only one-tenth to one-twenty-fifth of a second exposure is required.

posure is required.

In focusing the cumera a good plan is to remove the back of the instrument and insert a piece of ground fasts on, lecting that, an oldes injuster where the film disas on, lecting that, an oldes injuster where the film of the and examining the image with a hand glass for detail. The best results were secured when the camera was set

The loser results were secured were the collecter was set for fifty feet. The smaller the distance for which the camera is set, the larger the image will be. The method of using ground glass is also of value in determining the amount of light necessary and the even ness of its distribution. The camera should not be stopped down at all—that is to say, the opening should be as wide as possible. On a standard instrument this will be stop 7.5.

will be stop 7.6. By the processes described we have obtained various pictures of zeological interest. One of a spider leg, die the structure of the structure of the structure of the tearns and one joint of the leg. The long spines surrounding the joint and lining the children structure is may be seen distinctly. The pair of toolhed trendmai thuws and the halter sites an idea how the creature can wait our walks and ceilings with either resture can wait our walks and ceilings with either sites and ceilings with either the creature can wait our walks and ceilings with either sites and ceilings with either the contract of the contrac

the creature can walk on walls and cellings with ease The simplish; and lack of expense attendant upon taking such pictures as these should recommend freel-ing the mode for one in biology, chemiatry and phys-les clauses. Not only would the pictures be of great use for demonstration and lecture purposes, but the work of making a group of studies would afford as excellent experience for more advanced studients as well

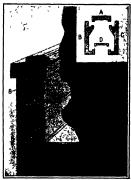
Motor Vehicle Lighting

THE chief of the electrical division of the Bureau I of Standards attended one session of the Society of Automotive Engineers at Spring Lake, N J., on June 21, at which the problem of headlighting for motor vehicles was discussed. The preponderance of opinion was that was uncensed. The preponderance of opinion was that so far as specification or lubratory tests of headlight devices was concerned the present status is fully satisfactury. It is, however, essential that more effective means be found to control the condition of headlights

The Negative Hole-Camera

A CURIOUS and interestin, reversal of the usual photographic procedure and result is not as familiar as its simplicity would merit. In a dark room a tighted candle is placed upon a table, in front of this is held a cardboard with a small aperture, and in the shadow behind the board a slacet of clear white paper

is hold a cardbowl with a small aperture, and in the shadow behind the bard a sheet of clear white paper. Under this arrangement, one seve on the paper is ready to the state of the state



Details of the latest scheme for reducing the cost of concrete construction. The four members A, B, C and D are precast in the factory and assembled on the job, and when concrete is poured into the space between them, a monolithic structure results

Concrete Shells for Concrete Buildings

BULDING with concrete has become so stereotyped that little thought is given to it by the public or even by those working in it. But the fact is, with forms for an ordinary dwelling house costing something like \$3000 if made under the conventional system a very considerable amount of inventive effort has been ex-pended with the idea of cheupening this first cost of a concrete residence. Some of the answers which have been proposed to this problem have been such as to

occar proposes to the promon may been such as occars of cheapen the house as well which is not what is desired.

One promising line of attack, however, which is usually free from this objection is the building of concrete houses without the use of forms on the spot at all through the use of pre-cast concrete blocks. The latest through the use of pre-cost concrete blocks. The latest development of this like a takes the direction of a concrete tile unit, 528712 in thes, weighing eighteen pounds, easily handled and rapidits set in structure freezembles the hollow clay tile. It is made with a wet mix, on an unionatic machine for quantity production, at a minimum cost, and it is claimed that it can comprete

with all common building materials in its field.

Based upon the concrete tile is another and even i recent type of construction. In this the amount of factory work away from the site is unfimized, the pre-causing is limited to the finishese for the hadde and out-side of the wall, together with caps for top and bottom, as illustrated at A, B C D in the accompanying draw-ing These are set up rapidly on the job and the space between them purered making in monditor of the entire assembly. It is claimed that there is nothing that cannot be built in this manner, no matter how small or large. per how high—whither wall, floor or roof, column, every instance it is the changest and quickest way



The negative hole-camera, in which the opaque at rediate glam casts an image, not of itself, but of the flame on the intermed

Colorado's Six-Mile Tunnel Under the Rockies

The Long-Deferred Realization of the Plans for an Air-Line Route from Denver to Salt Lake City

By Theodore Merrill Fisher

In the spic, the story of the expansion of the part of

covered and monitor, and the very to '1000 and '0000 and

ately made clear by the bifter and relenties opposition that the Vision Predict and the Santa Fe system offered because of the serious competition they provided Although these interests were able to cripple this project by cutting him off from custers financially the serious competition of from custers financially the serious competition of from custers financially the serious for the serious control gather, stak ing at the same time his own personal fortune on the success of the venture.

An important factor in Mr Moffatt a scheme—latter to be seen as a dist uniforg one—was the driving of a long tamel under the Continental Divide. As its cost was measured in terms of utilizes, the builders of the 'Denver & Salit Lake Rullway' were forced to adopt what they decined but a temporary route over the multi range of the Colorado Bockies.

When Mr Moffat died in 1911, a broken man, he had been able to complete but 214 miles of this pet project, scarcely a third of its con temp plated milenge The "Moffat Road" became, then, merely a local line, spending three-fourthe of its gross ince

needy a fived libs, spedifig.

In the almost monding struggle to keep lib right-focks your the "fact-those of the continent" clear of snow, with the additional terrific handlesp of a 6 per cert massimum grade. The scrap beau was the inevitable, final windings pince for its manner of the continent clear of snow, with the additional terrific and the scrap place for its continent clear the scrap leave was the inevitable, final windings pince for its continent clear that the scrap is shown as the scrap in the scrap and any unavailing attempts to see this accomplished through state and or overeith [Bowere, in May, 1022, the state and or overeith [Bowere, in May, 1022, the same the completion of the tunnel This provides for same the completion of the tunnel This provides for what has been designated as the "Motifat Tannel attack including leave—which is most immediately carried which which will make the scrap for the pict ting through of the whole state? Including leave—which is most immediately carried which will be safe in which will make the safe in which will be sometimed, and so before this account sees print the Transc Commission will have construction contracts ends for Modifus [6].

not actually let.
This incredible speed in getting things under way is
due to the fact that the determination of the tunnel
site will not, as is usually the case, have to be made a
matter of months of surveying and preliminary engl
meeting study. Mafor L. D. Blauvett, who was for many

jeurn sowisted with the "Moffet Bond," first as one of the original locating engineers, later as sweltant to the chief engineer, and finally as chief engineer, we that the third engineer, we that the matter very thoroughly for his company, deeding upon three founds latter and working out approach likes to each After mature consideration of all the was selected. This judgment is made binding on the Tunned Commission through the incorporation in the "haw" of a provision which definitely names this site as the one that shall be used. The tunnet's eastern portal will be about 50 miles from Dewre, just beyoud Tulmind Sintion—where the

The tunnel's eastern portal will be about 50 miles from Deaver, just beyond Tolland Sitation—when the road as at present operated begins its long and winding claim to the Core Human—and near the headwaters of the Core Human—and the contract the terms will be 4.04 miles the wret entrance being men the headwaters of France River, one of the mountain sources of the Colorado River. The east portal in the contract of the Colorado River and the contract is the contract to the colorado River. The contract is the word 100 feet in a stitute, the tunnel will reduce the "Mofrat Road" maximum climb into the at by roaghty, 2400 feet and

Although many engineers are urging that the Moffatt Tannel be made a two-track artery, it will carry but cone standard-gape line. The size of the runnel will be forest with, with a height of 20 feet above the rails, the suziliary bore will be either 7 by 5 or 5 by 10 feet, An innovintion in engineering practice which the build are of the Ropers Puse Tunnel worked out will be used

ers of the Rogers Fam Tunnel worked out will be used by those of the Moffat in its executation. In place of the standard method of a top baseling at each "those" and disposal of the "beach" by after blasting and powerslowet innecting, the following will be used. The floor slowet innecting, the following will be used. The floor slowet meeting, the following will be said to the floor slower blast of the slower blasting and the slower blasting and slower blasting and the slower blasting said will be blasted at each "face" A follow-up drilling gang will be considered the perliminary odd to the full size

required.

The undertaking is primarily a large-scale mining operation based on three cight hour shifts. As the pionese bore so materially fat illiates the removal of the nuck or spoils from the headings, progress becomes, in the main, a matter of drilling speed It is estimated that from two to three years.

that from two to three years will be required to complete this great hore, at least a year's time being saved in comparison with the old, single-tunnel plant As a sin single-tunnel plant As a sin would represent a cost of about a million dollars. from which we deduct something like a half million dollars which its use will take off the cost of excraving the

man studied mines to the net cost of the auxiliary hore is found in the use which will be made of it as a water conveyor. Anticipating future of the conveyor anticipating future rights near the head of Fra ser River across the continental divide A tunnel of impressive to make the supply available, and in the usual corne of events the city would later be compelled an available sources of supply on the eastern alope now appropriated and many thousand across of farm lands in-water for irrigation, Designation of the control of th



The six-mile Moffat bore will threw into the discard a 23-mile stretch of track where the read new climbs the range, with grades as high as six per cent and constant struggle to keep the line open

eliminate 23 miles of trackage. Aside from mastering the souw-clearmose problem already referred to, the maximum grade on the entire line will be cut to 2 per cent. The swring effected by this will be made replied by contracting the present handage of a 40-ton and alternation. Whereast cody it takes eight becomes to get such a train over Corana Summit, eventually one only will be needed for handage through the tunned in so doing away with the roads' chief handeep nowing the contracting the sum of the contraction of the c

when the the tree was the control to the control to

water for irrigation, Demver's new supply, as soon as carrying facilities are ready, will be at one in demand that the time when demented to see in demand that the time when demented to see in paramount, he day can derive an advantage of the second to th

Because the tunnel will be a public improvement purposed to serve as many uses as may be and free from possibility of monopoly, any railroad that wishes may use it At the moment there is one road besides the Moffat whose interests are intimately connected with

use it At the moment there is one road besides the Mofrat whose interests are instinctly connected with the building of the tumes—the Deaver & Bio Grands. There is no question take, as the as he identic like is conversed, the putting through of the ligh bow will be conversed, the putting through of the ligh bow will be conversed, the putting through of the ligh bow will be conversed, the putting through of the light bow being about its completion, thereby ogging up for devilopment a vast area in northwesters (bolerade and northwasters Utah, and setablishing the full significance of the Moffat road in the general spheme of transcontinuity through present the putting of the putting the significance of the Moffat road in the general spheme of transcontinuity.

Charles Doolittle Walcott By Marons Benjamin, Ph. D.

During the seventy-five years that have elapsed for the Advancement of Science no less than twelve of for the advancement of Science no less than twelve of the most distinguished geologists, beginning with Will-iam B Rogers in 1848 and ending with Charles R. Van Hiss in 1917, have been chosen to serve as its precidents. This year the Association again turned to a geologist for its isseed:

for its leader.

Charles Doollitie Walcott, the youngest son of Charles D. Walcott and Mary Lane Walcott, was born in New York Mills, Onded County, N. Y., on March 31, 1851 He is descended from Captain Jonathan Walcott, who came from Shropahire, England, and died in Salem, Mass., in 1669

Salein, Mass., in 1689
As a boy young Walcott developed a taste for natural history, and at the age of thirteen was already making systematic collections of fossile and minerais. His early education was received in the public schools of Utica, and in 1898 he was graduated from the Academy, they after which he spent two years in a hardware store in

rder to gain a commercial training.

It then became necessary for him to decide between a usiness career and one of research. A de-

business career and one of research A de-cision was quickly nucle and he settled in Treaton Falls, N Y, where he nucle a collection of the unique limestone fossils from that locality, which later became the property of the Museum of Comparative Zoology, where it had been his intention to study under Louis Aguests, but which was relinquished on the death of that great maturalist.

In November, 1876, he began his professional career as an assistant to James Hall, then State Geologist of New York, making thereafter extensive researches in New York, Ohio, Indiana and Canada Three years later, in July, 1870, he was appointed field assistant in the U S Geo logical Survey, continuing in that service until his resignation in 1907, having held until his resignation in 1907, having held in succession the appointments of palesa-tologist in charge of invertebrate pulsen tology (1889), seelogist in general charge of geology; and palesatiology (1880) and tology (1890) and palesatiology (1880) and tology (1890) and palesatiology (1880) and tology; and palesatiology (1880) and tology; and palesation of the expension of the three press, recognition and developing the Survey on selectificand business principles. During these years, bedden much route work, he examined and studied the Cambrian formations of the Appeliachian developing the palesation of the Appeliachian and carried his pressurches on a more seed

and carried his researches on a more east erly line through New England and New Brunswick to Newfoundland. He also began a series of Western studies, which gan a series of Western studies, which eventually included the most important bodies of Cambrian and pre-Cambrian rocks in Texas, Arisona, California, Idahu, Newada, Montana, Wyoming and South Dakots Later he turned his attention to the State of the State has the state of the S

Dekota Latter he turned his attention to a rich fossili locality in the Burgeoss Shale, near Fleid, British Columbia, from where he has obtained the finest and largest series of Middle Cambrian fossile ever discovered and the finest invertebrate fossile ever found in any forma tion. To the description of these fossis, including—be

sides brachlyods and tribblies—merostones, hobothuri ans, neduane, annelids and malacontracens, he has de-voted his leisure during recent years. He is, therefore, best known as a student of the Lower Paleosole (Cambrian) and pre-Paleosole (Algon kinn) sedimentary formations and included organic remains. He has himself described his work as follows

"My own investigations have been mainly in the Cambrian and pre-Cambrian strata, and have involved new and somewhat startling discoveries that helped to show how very much earlier life was developed on our planet than we had previously supposed. These re-searches have taken into consideration the records left searches have taken into consideration ine records wit on all the continents and many of the great islands. Field work, with compass, hammer and chiesh, has been the rule, followed by laboratory and critical comparison of many thousands of specimens of fossil genera and species of ancient marine life, and often study of nicrospecies of ancient marine life, and often study or micro-scopic sections of rucks and towells, in the hope of fini-lar evidence of the pressures of minute and active bac-seas and lakes, which by their united efforts form great imassis of the recent sea and lake deposits." During the years 1964-7 Dr. Welevit had charge of the organisation and confidence of the U S. Reclamation

Service, and also he had much to do with the development of the movement for the preservation of forests. It should also be mentioned that he was severatory of the Carnegie Institution of Washington during 19023—the formative period—after which he was a member of the Executive Committees, serving for a time as its charters. man. The success of these important enterprises, to which he has so freely given of himself, has naturally gained for him just recognition as a great organized

and executive

Som after the death of Secretary Langley, the never sity of finding someone especially competent to under take the task of administrating the important work of the Smithsonian Institution naturally turned all eyes towards Dr Walcoli, not only because of his known towards Dr. Walcott, not only because of his known and tried ability but also because of his long association with the National Museum as a curator and of which he was in charge in 19878, subsequent to the death of Dr. G. Brown Goode His selection by Inc. Respection was thoroughly approved by the selection by an expection of the control of the south of the Smith and ever since his acceptance of Secretary of the Smith and every since his acceptance of Secretary of the Smith and the Control of the Smith and the sonian institution and its dependencies they have been performed with rare fidelity and the utmost satisfaction. He has devoted much of his attention to the re-



Charles D. Walcott, incoming President of the American Association for the Advancement of Science

search explorations of the Institution, and among these the African Expedition of 1999-10 under Colonel Theodore Rossevelt is the one most widely known. That he may live long and continue to contribute his valuable energies to the administration of science is the abundant testimony of his colleagues in Washington.

dant testimony of his collection in Washington
Dr Walcott's activities in other directions are many,
but of two specific mention must be made. During the
period of the World War he became chairman of the
National Advisory Committee for Aeronautics, and he was chairman of the military section of the National Research Council

The results of his many investigations have been are researed or nis many investigations have occur
ativen to the world chiefly through the publications of
the U.S. Geological Survey or the Proceedings of the
U.S. National Museum, and more recently, the Smith
soulan Miscellaneous Collections, and in addition to
those sources there have been frequent papers in the
designate in the contract of follogical and similar explanations. American Journal of Science and similar publications, both at home and abroad. His entire bibliography is quite extensive and includes more than one hundred titles of major important

nanared titles or major importance. His scientific attainments have received deserved recognition by the conferement of the Hayden metal in 1965 of the Academy of Natural Sciences in Philadelphia, the Higsby metal in 1965 and the Wollaston medal in 1918 of the Geological Society of London, and the Gaudry wheelal in 1917 of the Société géologique de

France Academic appreciation of his distinction is shown by the following honorary dectorates in law from Hamilton (1987), Chiano (1991), Johns Hopkins (1982), Pennsylvania (1983), Jule (1910), 8t. Andrews, Scotland (1911), and Pittsburgh (1912), doctorates in science from Cambridge, England (1990) and Harvard (1913) and a doctorate in philosophy from the Royal Fredericks University of Christiania in 1911

Fredericks University of Christiania in 1911.

Solution and candenies have been proud to add his name to their lists of distinguistics members and in name to their lists of distinguistics members and in Secretic global group of the property of the Secretic global group of France, be tolds honouray or corresponding relationships in the Boyal Geographical Secrety of Naturalists, the Christiania Selectific Secrety and in the accordance in Bologona Home Stockholm and Paris, in accordance in Bologona Home Stockholm and Paris, in the latter of which he is one of the very few American corresponding members. At home he is an associate fellow of the American Academy of Arts and Sciences a vice-president of the American Philosophical Society and a past president of the National Academy of Sciences Also he was president of the Washington Academy of Sciences (1800-1910) and of the Archaeological Institute of America (1915-17) He has served as president of the Cosmos Club (1898)

His connection with the American Asso-

clutton for the Advancement of Science be-gan with his election to membership at the Buffalo meeting in 1876, and six years later he was advanced to the grade of fel low. In 1893 he presided over the section on Geology and Geography and delivered in address on "Geologic Time as Indicated by the Sedimentary Rocks of North Amer ica. At the meeting held in Boston last Winter he was chosen president of the As-sociation, thus confirming his standing as so islien thus confirming his standing as the foremost geologist of America, a fact further certified to by the statement made when he was presented with the Wollaston medal that "his personal researches have excited interest and admiration wherever

Physiological Effects of High Temperatures

VENTILATION is of little use in reducing discomfort from high temperatures in humid air after the temperature has risen to approximately that of the human body, according to a report of recent ex-periments made by the United States Bueau of Mines on the physiological effe of high temperatures with and without air movement. In temperatures up to 95 de-grees the movement of air caused much relief. At 100 degrees the symptoms were fully as severe with moving air

with still
The experiments were curried out by
Dr R Sayers, chief surgeon of the
Bureau of Mines, and D Hurrington,
supervising mining engineer The amblets
were experienced unlie laborers. The work
was curried on in deep and hot metal

The principal effects of exposure to b

The principal onects of exposure to not hundl and stagman air were a rise in the body temperature of two or three degrees, a full in blood pressure, perspiration so profuse that the sub-jects shows were partly filled with sweat and semsations. jects snow were jartin lined with sweat and accusations of diddiness and weakness. These symptoms were all very pronounced at 95 degrees in stagnant air. If the air were in moderate motion little discomfort was felt. This was not the case, however at temperatures of

98 degrees and more "Symptoms in still air which were more trying than at the lower temperatures, were not much relieved by a current of air, while at 100 degrees moving the subjects were not able to stand a full hour's exposure to the conditions.

More recently a more thorough study of the effect of high temperature has been made possible through the use of a specially designed room where any desired conditions of temperature bumidity and air movement

which are likely to be met may be maintained From this a system of "comfort lines" is being worked r ron mas a system of comort mass is being worker out, a graphical representation of the combinations of temperature and moisture at which equal comfort is experienced. It has been shown that while hundity has a marked inducate the temperature taken by the ordinary dry bulb thermometer is of great importance. The discomfort experienced is shown to be due more to the increase in the pulse rate than to any other cause, according to findings of Dr. Sayers of the Bureau of according to findings of Dr Sayers of the Bureau of Mines, and D Barrington, supervising mining engineer



Left: Dust from a mine-ventilating shaft, magnified 2000 diameters. Conter: Section of a human lung showing deposits of conl-dust and sect in cell the that defined with the wind across the Morth San to England: magnification, 1600 diameters A few rather surprising sumples of the air we breathe, showing its dust content

The Air We Breathe

New Types of Apparatus for Measuring the Suspended Dust in the Atmosphere By John B C. Kershaw

BW of us are unfamiliar with the old experiment of allowing a beam of smallgab or of same strong artificial light to of same strong artificial light to a company as a darkened chamber or room, and with the antilliness of dust particles which float suspended, but in perpetual movement, in the air it is not as generally known however, that the study of this suspended matter of the stunosphere is now being placed upon a more scientific basis, and that instruments have been devised and are now in use which permit the number of these suspended dust particles to be accurately recorded, and their character to be examined

It has, of course, been known for many years that the finer particles of soot and ash discharged from high the inter parties or shot and san darken greet from night factory chilimpsy could be carried by wind and all currents for many miles over the surrounding country-side but the distance at which regentation ceased to be destroyed or checked was supposed to mark the extent of this transport of injurious dust and vapor in the neighborhood of industrial towns and districts. Some neumornood of industrial towns and districts. Some experiments carried out last year, however, by Dr tweens of the British Mcteorological Office seem to indi-acte that the finer suspended dust particles of air can be curried to much greater distances than has hitherto be carried to much greater distances than has hitherto-bers supposed, and that under flavoring circumstances and atmospheric conditions, they may seen be trans-toned to the conditions of the conditions of the free of the conditions of the conditions above in our first illustration, which Owens found in the air on the East North Sea, on the Condition of the Conditions of the on the East North Sea, on the Condition of the Conditions of the outerly also currents and had come probably from the smoke discharged by factory chimneys of Belgium or Germans

It is well, therefore, to take cognizance of th It is well, therefore, to take cognizance of these new methods of dast observation and of their results, If the comparatively harmless fine ask and dust particles from industrial centers can be carried by air currents for such great distances over intervening seas and oversuns, disease germs and other deleterious dust par-ticles may be disseminated in the same manner, and the ticles may be disseminated in the same manner, and the possibilities of infection or attack by air will have to be studied from quite a new standpoint. Some of the may be due to air borne germs, and not to infection by

The instruments which have been devised by Dr The instruments which may been developed by Dr Owens for the collection and examination of the sus-pended matter in the site are highly ingenious. In the case of his alre-sampler, the difficulty caused by the relative smallness of the amount of suspended im pority in the air in comparison with the volume of the pority in the air in comparison with the volume of the air which centained it was overome by reducing the area of the filter-paper used to very small dimensions— to a diameter of one millimeter, in fact. The paper was apparents by turning a milliochand screw and 9000 cubic centimeters of air was then drawn through the very minute area of filter-paper exposed between the two openings of the brane headpless of the apparatus, a

water-aspirator being employed for this purpose. A water-aspirator being respectively thus produced even distinct coloration of the paper was thus produced even the school and dustless atmos by what appeared to be a clean and dustless atmos-phere, and by use of a scale of numbered tints, ranging from pale gray to black, a reco

from pair gary to black, a received was obtained and filed from pair gary to black, a received was obtained and filed in the atmosphere at the time of the observation. A later model is operated on the man principle, but is automatic in action, and takes a series of records of the automatic in action, and takes a series of records of the automatic in action, and takes a series of records of the automatic in action, and takes a series of records of the automatic in action, and takes a series of records of the action pass the fact that when air which contains dust and a sufficient amount of water vapor has it pressures subsciently reduced, there is a fail of tension of the series of ment this result is brought about by causing a very mise ribbon-shaped jet of all to strike a microscope cover-glass, placed about one millimeter from the opening forming the jet. The air before entering the jet passes through a damping-chamber, and the velocity in the jet



The Owens automatic air filter, with attack raised for charge of recording diffi

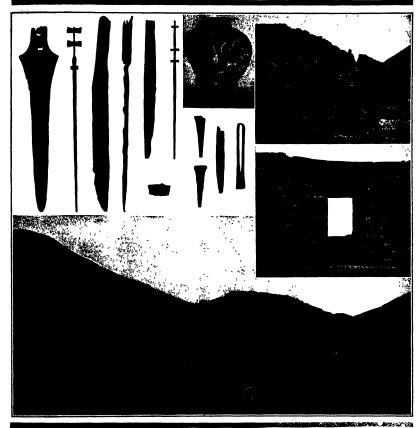
is such that the fail of pressure results in bringing about a condensation of moisture on the dust at the moment of striking the cover-giass. The air is then de-fected, and as the velocity fails off, the pressure and temperature rise, the water is evaporated, and the

deposit on the glass.

The apparatus is so arranged that the record con ans apparatus is a arranged that the record con sists of a linear deposit of dust, and a count of the number of particles may be made by the aid of the eye-piece micrometer, a strip being counted completely across the record at several places and an average taken, to be multiplied by a factor depending upon the length of the strip and the spacing of the sample

countings.
It appears probable from the tests already made by
It appears probable from the registal space consistency
to the depth of the registal space consistency
to the depth forcity in November 200 and the depth forcity and the depth forcity and the depth forcity and destinated and destinate gray or builst have we seen against distant object, the tests revealed the present probable and the depth forcity and the destination of the particle in the six of the destination of the particle in the six of the particle in the s

Another application of the apparatus is in the examination of expired air, with a view to ascerting whether the suspended impurities in the air breather are retained or expired. The experiments made as indicate that the tidal air expired contains a large province of the suspended matter which was impliced, lungs, while containing very much less than the tidal air, still contains also some of the suspended matter breathed in. An important result obtained was that the quantity of dust in the deep parts of the image depended chefty upon the nature of the breathing; that in, "deep breathing; that in, "deep breathing from any cause carried dust into air under such conditions was found to be laden with dust. Another application of the apparatus is in the exam



A T. Mycenae, the city of Agamemnes, new pages of A. T. Marty, in being movement to the control of A. T. Marty, in being movement of the control of A. T. Marty, in the control of Arty and the contro

both imagination for drawing plans and knowledge for making calculations and construction. The pulseform of the plant of the plant of the plant of the a large building with several toxicise. The palace was built about 1460 B C. Other work included the extended to the plant of the plant of the plant of the of Moutt Hodge Elliss (2000 feet) whence the news of the fall of Trey might have been finished by fretoning slow that the later members of the fairly seemed to have had no erupies in sweeping acido, or even throwing notice the bottes and other relies of the carrier interments and appropriating, valuables. Our photographs above the ancient Greek waspens were partially as the state of the control of the contr

The Heavens in December, 1923

Mathematical Theory and Observed Fact Regarding the Nebulae

By Professor Henry Norris Russell, Ph.D.



E spoke last month of the spiral nebulas spoke man mount of the spiral measure-their stranger motions, and enormous size. No one could follow such a story without the instinctive question, 'litt what are these nebulae? Have we any idea of their real nature?

Though this hold query cannot be answered with assurance today, we are by no means in utter uncertainty.
The astronomical world possesses a theory of their nature which matches the principal facts so well that, though "not proven," it commands the sympathy and indeed the belief of the most competent authorities.

Perhaps the most remarkable feature of this theory is its origin. For once, we come on the rare case of a hypothesis of great practical attractiveness which originated, not from a study of the bodies to be explained. but from purely theoretical considerations de

the investigation of a highly generalized problem

We refer, of course, to the remarkable work of
Jeans—one of the most distinguished of English mathes, who has hardly a rival in that difficult field where mathematics, physics,

difficult field where mathematics, physics, astronomy and geology may dispute the sovereignt. The abstract problem which he was discussing was the old and intri-acte one of the behavior of a mass of ro-tating fluid. Such a mass, if isolated in tating find. Such a miss, it isolated in space would settle down, under its own gravitation, into some definite figure of equilibrium. If the miss was not rotating at all this figure would obtionsh be a spaces. If the flutt was facountressible, its density would be the same everywhere, if our presents in the control of ably much denser-at the center but still

Let us now suppose the mass to be in slow rotation. The problem is more com-plex we have a centrifugal force, acting outward in the plane of the equator, combining with gravity. It is easy to see that if small, this force will make the body bulge out at the equator and flatten down at the poles. But the amount of the bulg at the poles. But the amount of the bulg ing is not easy to compute, for the very change of shape alters the gravitational attraction at the surface. For slow rota-tion, however, the problem was solved a coatury age—at least, for the homogeneous mass. The cross-section, along a meridiun, becomes an ellipse while the equator is still a circle. The earth and Jupiter, though denser toward their center, illustrate this case

Figures of Equilibrium

But what if the rotation grows more rapid—as must actually happen if the mass cools down and contracts? In this event, a homogeneous mass will become more and more flattened at the poles, with

inter a un more interested at the posses, with its equator circular, until it reaches a certain limiting shape and then a strange thing happens. The equator itself becomes elliptical, and the mass resembles in form a cake of tollet son, rotating about its shorter axis. With increasing rotation, the long diameter of the equator becomes twice, and even three times, the other, so that the figure is almost eight-shaped Then again a change occurs. One end of the "eight tends to clongate and the other to become short and thick At this wint the mathematical analysis becomes appall ingly complicated, and it was not until Jeans attacked the problem (a little matter of a year or two of calcu-lation) that it was cleared up.

lleyond this point, he finds, there can be no real rapidly, the other fattens, and a neck forms between them. Doubtless this neck soon breaks, and we get two independent masses rotating about one another, and almost in contact--after which the friction of the tides which they raise on one another will drive them slowly

apart, as Darwin showed years ago.

Praclically every stage be ond the point of actual separation is evidence as a mong the eclipsing variable stars. But those stars are formed of compressible gas, and must be confessed toward their centers. How will this affect things?

This problem is even a more difficult one than the other, but Jeans has successfully attacked it. If the central condensation is small or moderate, the course of nts follows essentially the line already sketched But events follows essentially the line already sketched. But if the outer juries are of low density and the central condensation great, the whole story changes. For slow rotation the shape is much as botton, but as it splits more and more localized at the equator, and it comes more and more localized at the equator, and it comes to recemble a Goubs-conway tens for a rendingegiass without the frame). Finally the equatorial edge, at first rounded, becomes quite sharp. At this stage the centrifunal force at the equator just balances gravity, and for any further rotation something, must break and for any invitor rotation something mass never the surface loose. For a mass quite Isolated in space, the surface portions would begin to apread out in the plane of the equator into a wide, flat sheet. But no actual body even in intersection space, is quite isolated. The attraction of the neighboring stars at least, must act upon it and produce forces of the same nature as those which raise

At 11 o'clock: Dec. 7 At 10% o'clock: Dec. 18.

NIGHT SKY: DECEMBER AND JANUARY

tides in our occurs. The outer edges of the lens-iped mass, in this critical state, will be very sensitive shaped mass, in this critical state, will be very sensitive to the smallest forces, and the outcome is that the out-flow of matter, thrown off by the rapid rotation, will take place at two opposite points on the equator, the "high-tide regions," so that it will escape, not in a sheet, but in two oppositely directed streams. If the quantity of outflowing material is small, it will dissipute into space, if it is large, the mutual attraction of pure arro space, it it is large, the mutual structions or the particles will keep the stream from spreading out interally, and it will form a long filament. There is, however, a drong tendency for such a filament to break up longitudinally into separate bits, just as a narrow jet of water (under quile different forces) breaks up into separate drops. So our rotating mass, if huge enough, will surround itself with a swarm of small con densations arranged in streams along the bulk of the filaments from which they have been formed, and issu-ing from two opposite points on the periphery of the

Mathematics and the Nebulae

All this came as a definite, but in a sense unexpected, result of Jeans' mathematical reasoning. The resent biance of the resulting picture to that actually presente by the spiral nebulae is striking to a degree. Indeed

almost every form predicted by the theory, from the globular mass, through the sharp-edged one, to the nucleus surrounded by innumerable condensations, can nucleus surrounded by immunerable condensations, can be found repeatedly on nebular photographs. If such a success was not enough, it must be added that Jeans, and the surrounded of the surrou which is consenant with what other information we can get upon the matter, while the masses of the nuclei must be enormous—in the Andromeda nebula. No other theory of spiral nebulae has no far been proposed which is anything like as satisfactor; Jist many difficulties remain. One is found in the fact, clearly proved by van Maanen, that the motions in the outer parts of the arms in-

consider in the outer parts of the arms the creams as if alwardwise force was acting upon the portleles. Another is that the spectra of the central portlens are just what might be expected from a cluster of the individual starts should be always as the individual starts should be aboven on much failter, but rindically, than the mail the property parts before, or even ten, there may be other chapters to add to our story-qual in interest to any that have no far equal in interest to any that have so f been read.

The Heavens
The whiter skies are now in their full
glory. Orion blazes high in the southeast,
with Thurus above and Strine below Pro
cym, Castor, Pollux and Regulus are all
in the cent—the last rising. The Great
Hear accords in the northeast, the Dragon
swings low in the north, and Cassiopela
and Combens are shirling in the northware awings tow in the north, and Cassiopeias and Cepheus are staking in the northwest, above Cymus, which is setting Auriga and Perseus are overhead, Andromeda, Aries and Perseus in the west, The south west, with the sparse stars of Eridanus and Cetus, is the only duil part of the sky

The Planets

Mercury is an evening star all the month, but is so far south that he will be hard to see. The best time is about the 27th, when he is farthest from the sun,

and should present a pretty spectacle.

Jupiter, too, is a morning star, but much nearer the

Jupier, too, is a morning star, but much nearer the sun, and does not rise until nearly 6.4. M Unnus is in Aquarius, and is in quadrature seat of the sun on the bulb, so that he can be observed all the the sun of the bulb, so that he can be observed all the the sun of the bulb, and rises about 2^p M. the middle of the month, and rises about 2^p M. on the Int. The most is in her last quarter at 5.4. M on the 18th, and the 18th, first at 8.4. M on the 28th, and her last quarter again at 4.9 M, on the 28th, and her last quarter again at 4.9 M, on the 28th, and the sun secret the serior of the 6th of the 18th 19th. During the mouth she passes near Saturn and Mars on the 4th, Jupiter on the 6th, Mercury on the 8th, Venus on the 9th, Uranus on the 14th, and Neptune

venus on the stn, Urana at again on the 26th house again on the stage (though not the constellation) of Capricorn—and, in almana language, "winter commences."

Princeton, N. J.

Oct. 1, 1928.

Metering Water by the Wholesale

7AST quantities of water are used by modern large V hydroelectric power plants and the problem of metering this water, wherever this is required, is not such a simple matter as would at first thought appear anteriori final water, wherever this to required, is not auch a simple matter as would at first chought appear and a simple matter as the simple matter and a simple matter in the transfer of the simple matter in factoriary accurate when the work involves such large monosites of water in Insteriors, where is often weighted in tanks, made to tip automatically when filled, and spill the water fino other receptable. Nothing like this could possibly be used in such large power installations, for instance, a certain one which uses \$500 cubic

as, for instance, a certain one which uses 6320 cutor feet of water per second.

A new method of measuring water has been worked out by Professor C M Allen, of Worccaster Poly technic institute and in practice has then remarkably accurate the contract of results. Common solt or sodium chloride increuses the electric conductivity of water and this increase is in direct proportion to the amount of sait in solution Brine is introduced into the pipelines at a considerable distance upstream and automatic timing devices record the changing conductivity of the brine as it passes given points at which electricies are inserted on opposite sides of the line By dividing the volume of the pipe between the two points by the rate of passage, the rate of flow is arrived at. When tested against the weir and Ven-turi meter the new method is found to be very accurate It proves superior to the method of measuring stream flow by the submerged float method and it is vastly better than the method which requires expensive tanks,

Pulling Down a Church Steeple With a Motor Winch

A STRIKING example of the all-around usefulness of matter track whiches was brought to light the Church, one of the city, so do landmarks, was being wrecked to make way for a new hotel Higgins, described to the city of the around the city of the from the top of the steeple to a motor track which from the top of the steeple to a motor track which to until the steeple over the calles sungeed. A raw cubic to null the steeple over the calles sungeed. A raw cubic to pull the steeple over the cable snapped. A new cable was attached. The winch operated by the truck engine wound slowly around. After straining and cracking for about three minutes, the steeple fell with a crush that could be heard for several blocks Small capstan winches, operated on the motors idling

power, are coming into widespread use as regular equip-ment on motor trucks. They are used for a surprising number of jobs from hoding trucks to hauting heavy hollers, from holsting safes to wrecking buildings

Chewing Up the Soil for Better Crops

On the American inneket today there are several only from England conset today there are several new from England conset the description of one which differe radically from the American variety in that the soll is worked by a revoluting inconder called a million, instead of by the common toothed cultivating attack-The function of the miller is to chew up the mixing, lightening and incorporating it thoroughly with the fertilizer that has already been spread over it

The rototiller is driven by a two-cycle, 8 to 10 horse-ower engine Lubrication is provided by mixing the oil with the gasoline in the tank, as in small engines used on motorboats. The engine is cooled by means of a radiator of two gallons capacity and by a fun running on ball-bearings. Ignition is by high tension magneto As in the case of the garden tractor the controls are led to the handleburs. The motor is equipped with an



air-cleaner working on the

wheels are 18 inches in diam eter and the extreme width over all, without the regular 30-inch miller, is 24 inches. The miller is driven by a The miller is driven by a bevel pinion and crown wheel enclosed in an extension of the gear box which forms part of the body and these

run in oil The milier drive is independent of that of the bull wheels, permitting the rototiller to be moved about without operating the rototilling member or miller. The inter revolves at 150 rpm and carries twenty coil springs on whose extremities are fitted



An odd spring suspension which takes the place of the usual shackle arr ment and which is said to make for greater riding comfort

This church steeple is being pulled down by mea a motor-truck winch and heavy cable

twenty semi-circular hooks of steel. These are the tools which attack the soil. The total weight of the machine is 650 pounds and its height is 37 inches

One of the most satisfactory qualities of this culti-tating device is its low speed. In order to do good work a garden tractor should

not be genred so as to run as fast as three miles per hour n speed at which the control of the tools is erratic, espechily in rough or lumpy soil, ore the low speed of the rototiller is an advantage

TAIC is by no means used only for the manufacture of talcum powder. Much of it is unsultable for this purpose and is used in pain pose and is used in paint as a body material for filling paper, for use in the manu-facture of rubber, and roof ing. Much of the tak used comes from northern New York Vermont and Virginia The tale rock of New York is mined and brought to the tale mill where it is ground in ball mills until it will pass a 3.25

Taking the Roughness Out of Ruts STILL another device for taking the roughness out S ruis now makes its appearance. This time it is in the form of a new type of automobile spring suspension.

the form of a new type of automobile spring suspension, worked out by L. H. Humens of Des Moines, its Constructed on the theory that unsprang wight is the enemy to tiding comfort Timmons, through the medium of rolling contact bearings and relief springs, mention or roung contact nearings and rener springs, has colved a type of spring suspension which is shown in the necompanying illustration. The rear auxiliary reliaf spring here shown is composed of doubt trans-verse straight laminated springs, secured at their centers with a roller bearing oscillating joint between, Pach end of the upper spring is connected to the side frame by means of a roller bearing device. The lower springs are held in contact with the side springs by a rubber padded stirrup with a bull bearing between the springs making a frictionless connection and allowing a greater range of spring or axie movement than with the usual construction

The front relief spring is a quarter elliptic laminated spring attached to the rear end of the present semi-elliptic side spring by a connection encusing a barreled roller bearing, the thick end being rigidly at tucked to the frame cording to the inventor, is the same as that of a long straight spring, since the arrangement allows double the straight spring, since the arrang mean anow commerter ordinary range of spring, movement. In this manner noiseless spring commertions take the place of spring stackless which are subjected to heavy londs. Samblers from ark to frame prevent exceeding them, and

Asphaltic Types of Pavement

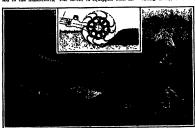
Asymmetry types of the United States there is rough paround to cover an eligitive foot street that would twice entirs the glob. This mileage by far ovceeds that of evers other country of the world. Of this total amount of pavement 78 per cent is of the type higher than waterbound macadam, including about type inguer man watermount inactions, among among 22 per cent of brick, 11 per cent of stone block, 3 per cent of wood block, about 6 per cent of portland coment con rete, 25 per cent of tur macadam and 54 per cent of asphaltic types.

The overwhelming predominance of the asphultic types of prevenent indicates the determination of modern cities to eliminate dust, noise, shock and interrup-tion to truffe in street construction as far as possible

The vast network of underground structures in Amer-ican cities, including wires, pipes and conduits, make it necessary to open the payement at frequent intervals to obtain necess to these underground services. The or omain access to these underground services. The engineer must, therefore, provide a purvenent which can be cut through without great trouble and expense, which can be readily repuired and which, after it has been repaired, blends with the old parement. For fast mother traffic.

For fast moving traffic the modern city pavement must be smooth not only to permit the rapid and comfortable movement of vehicles but to conserve motor fuel and tires. Only a slight saving in the operating thet and tires out a single saving in the operating cost per motor vehicle by reason of the smooth pavement reaches an aggregate, when the vast number of motor cars is considered, to justify a considerable outlay to obtain durability and smoothness.

ct or the pounding of heavy motor truck wheels, impact or the pounding of heavy motor track wheels, has attracted the anclosis attention of cits highway engineers to an increasing degree during the past ten years. A track wheel with a drop of only one lind when in motion delivers a blow equivalent to at least six times the dead wight? Cits engineers therefore attach increasing importance to the fivibility and resillency of city pavements so as to take up the shock of impact.



Retotilier in operation, with a diagram showing how its nemi-circular hocks tear up the soil and leave it in a pulverized, aerated condition for planting

413

Broaklyn-Bichmood freight and passenger tannel, which in to pass under the Narrown, aborting tin connections with treaklise railreads in New Jones

The country of the co

Inventions New and Interesting

A Department Devoted to Proneer Work in the Various Arts and to Patent News



Drip Coffee by Machine
An automatic coffee dripse to make
An all Tweeth coffee that does away
that a life of the second of the s Drip Coffee by Machine coffee in an ordinary 3 r nsch drip coffee pot A stup valve prevents the hot water from rising into the reservoir A small pipe exhausting through the reservoir and into the large pipe leading to the heating chamber takes care of the expansion when the nourie opening int i large enough to exhaust the full rush of bolding water and steam

The T-Square that Stays Put THE T-Square that Stays Put A NEW combination drafting instru ment uses a suction cup for holding it to any surface it is placed upon The cup is infinited by pushing on the knob of



Suction-enp attachment for helding drawing instrument to the board

the handle as illustrated It will hold the instrument to the board from ten to fifteen minutes. The cup can be turned out of the way when not in use The instrument combibes a protractor rule and I square All angles are quickly reg issteed by operating the instrument continued around the pivot point which is the suction cup. The holes in the rule are found. chalk points and are placed every inch for describing circles

A New Method for Determining the Rate of Sulfation of Storage Battery Plates

STORAGE batteries have recently come into very extensive use particularly in connection with automobiles and any in connection with automobiles and any thing desling with the proper method of caring for such batteries is thereft re of considerable general interest. The life and afficiency of storage batteries depend upon the purity of the materials used in or natructing the plates and on the purity of the electrolyte. But little exact in formation is available on the effect of imputities in the solution which serves as the electrolyte and the methods ordi

as the electrolyte and the methods ordi-natily employed for determing the effect of such imputities are time consuming and often inaccurate.

A new method has been devised by the Burnau of Standards for measuring the rate of sulfation of the plates resulting from total action. This method is raid and accurate but requires some special and accurate our requires some special apparatus. By this meth d a study has been made of the rate of suitation of both positive and negative plates in solu-tions of varying concentration. The results are described in Technologic Puner aults are described in Technologic Paper
No. 225 of the Bureau of Standards
which may be obtained from the Super
intendent of Documents Government
Printing Office Washington D C at 1 ents a copy. This paper covers the first step in a more extended investigation of the effect of impurities

Discussion of Logging and Safety Code TYHE Bureau of Standards has pre-layed a discussion of the recently adopted safety code governing legting and saw mill operations. This discussion is intended to explain why certain provi-sions are included and also in some in stances to give further details concern stances to give further details concern ing methods of aufe operation. It will be recognized that this is in line with the discussions published on the National Feetrical Safet; Oods, known as Hand book No 4 of the Bureau of Standards and the discussion of the Fleed and Etc. Code cettiled Handbook No 2 of the Bureau of Standards The discussion

Code cettified Handbook No 2 of the Invent of Naudards. The discussion will be illustrated by Indooraryha taken will be illustrated by Indooraryha taken the United Ratues borest ferrice and various State estambledon. One interesting item in this discussion is the description of the W notch method the Coulombook of the Parken of the Southern Pine Association for the purps of preventing 'kick backs' of the Southern Pine Association for the purps of preventing 'kick backs' of the butt of the log us the tree full Not only was this method successful in pre-time to the gas the tree full Not only was this method successful in pre-time to was found that it gave larger yields of sound timber than the old method of making a horizontal cut A resprednetion of the poster published given in connection with the description of this method stem in connection with the description of this method of this method.

Micrometer and Snap Gage in One
A N automatic spring driver measurA in automatic spring driver measurA in automatic spring driver measurth in object being measured, considers
the tractions of the land nitronester and
the formation of the land nitronester and
increments having an operating range of
600 inches, an adjustable runge of onehalf inch and an interchanguable toke
unce segment on the finder arm it is
the work. The micrometer applied is
automatically released, automatically set
to a definite pressure and automatically
let-let or retain the reading as the in
arrament is withdrawn. It follows up
hand to receive the next piece
Tr automatic action eliminates all Micrometer and Snap Gage in One

hand to receive the next piece. The automatic action eliminates all need of skill or training in its use. There are no micrometer scales to be read and interpreted. There is no reading to be read and contempered. There is no reading to be received in the second of the read and interpreted. There is no reading to be received in the second of the read sero at the fainh size. It then reads directive to be reflected. The reading is automatic to be reading in a store in section of the reading in the section of the section of the reading in the section of the secti ically returned and the machine tool raw be accurately set for the next reduction or the finish cut. There is no guesswork or time lost in working down to size. The operator gives all ils mudvided at tention to the efficient reduction of the work within the acceptable precision as graphically shown on the tolerance plate.

A measurement takes only two seconds with one hand. It can be taken in any position and from any direction as there is no mechanism to be manipulated and the dist need not be in view. The dist is large the scale open the lines and figures distinct and the zero in the same central position for all adjustments

It is always adjusted and used to the

It is always adjusted and used to the indx line representing the exactly correct size of the product. The user alma at the currect size and produces a substantially correct average size, while the tolerances are employed as the occa sional extremo deviation conceded in the interest of rapid and cheap production.

Method for Making the Interior of Automobiles More Comfort-able in Hot Weather

A TTENTION has been called previ creating the best radiated through a test or (the High covering which is exposed to the sun By couting the under side of the test cloth with aluminum paint the last radiated from the under side of the state of the sun and the sun and

wagnia, etc. consist of cloth, the outside of which is often painted with a black composition which absorbs perhaps 90 per cent of the sun s rays. Practically half of this is reradiated from the under side of the cloth Tests are in progress at the Bureau of Standards which show that a coating of siuminum paint applied either to the outside or inside of such tops reduces by 50 to 60 per cent the intensity of the heat radiated from the under side into the interior of the con-



surb fate

The Individual Radiator

I REPORTED THE RESIDENCE AND A THE THEORY OF THE PROPERTY OF T some sort, radiating its best directly into the atmosphere of the room Whether the stree be a wood coal or oil burner, the stree be a wood coal or oil burner, but the street between the street of the street of moisture content in the room, there are serious dewaheds to this pre-ture of the street individual radiator which we lituative terestin This bottom tank of gasoline feeds the two burners in much the same feed the two burners in much the same street of the street of the street of the street of the streets of the street of the street of the street of the streets of the street of way as with the convent and gasoline or keroment water laster. These burners heat the air in the smaller quindrical chambers also we them and the hot air chambers also we then and the hot air compartments her below and compartments are compartments her below the con-compartments have below the set up through the radiator, and the latter radi-state heat to the room just as does the radiator of the conventional hot water beating systems. The radiator tubes are





Clearing the kitchen drain without sending for the plumber

of copper. Fuel and water for a week's operation, it is claimed, are supplied at a single charging of the tanks. The ap-paratus in recommended, and is obvi-ously of value, for isolated rooms and unheated apartments.

Accuracy of Analytical Weights

Accuracy of Analytical Weights
A Instance of sustained accuracy in
A the weights which are now being
submitted to the Bureau of Stundards
for test was noticed during the past
month. In a shipment of fine seets, con
taining a total of 216 weights, all were
within the required accuracy. Only once
before has a larger number of seets benchmarked
and the seed of the seed of the seed of the seed of the
hard of the seed of the seed of the seed of the
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seed of the seed of the seed of the seed of the seed of the seed of the
seed of the se courances. Ine ract that such shipments are now received, even if only occasionally, is an encouraging indication of the good work done by some American makers. It need not be said that such sustained accuracy would have been entirely out of the question as recently as ten years ago.

The Renewable Eraser

THE consumption of circular erasers in the ordinary office is very heavy, and these handy little correctors consti-A in the ordinary office is very heavy, and these handy little correctors contained and the second of the breath (if the breath type be used) cost the magnufacturer more than the abreatwe manufacturer more than the abreatwe manufacturer more than the abreatwe manufacturer more than the sput out a model designed to save these portions and the eraser essential from the waste beautier. A new sense goes in the second of the eraser goes in the second of the particular, a little is a second of the second of



The Home Plumber

The House Plumber

If the best regulated families, onthe
grounds and grease get into the drain
of the kitches sink and check or stop
easiriely the flow of water. The handy
little aid to good housekeeping shown in
the accompanying photograph stessis a
few plums from the plumber and enables
the mistress of the house to clear out of
the pipes hereaff. It is touch, as abown, the pipes herself it is used, as shown, with a little water in the hesto of the sink. It works through hydraulic pressure, and is powerful enough to force down into the trap almost any accumulation that may be in the pipe.

Medicine to Breathe

medicine to Breathe

PHYSICIANS often prescribe the inhaling of medicated vapors in treating coughs and other disturbances of the
chest cavity, the new and the ing coughs and other disturbances of the cheet cavity, the nose and the throat But a proper and continuous supply of the vapor, of uniform concentration, has not been easy to obtain. The croup ket-tles, steum atomisers and inhalers of fored have been but halfway measures, lacking the proper efficiency

A very elever invention has, according to the claims made for it, solved the problem. The idea is that of the old-fusbioned lamp wick, but the wick does not carry the fuel. It carries, instead, the medicated liquid which it is desired to vaporize for the patient to breathe, It draws this from a reservoir, just as It draws this from a reservoir, just as the lamp wick draws its oil. The wick in the nadiodor, as the apparatus is called, however, passes over the surface of an electric light globe of a type whose luminous efficiency in a rather low, and which therefore develops more heat than would be desirable if it were being used as a source of light. With the wick carrying the medicated liquid in minute but uni-form quantities to the large, evenly heated surface of the globe, the fluid vanorises at once and at a constant rate. vaporizes at once and at a constant rate, and the patient is assured of exactly the atmosphere which has been prescribed for him. A larger and more elaborate model than the original one just de-



Don't throw away the handle of the

scribed passes the medicated vapor through a water-scaked gause cylinder, reaching the patient only after this filter-ing, and giving double assurance of a er vapor continuously and evenly

The Exploding Plow
SOMETHING new in plows is being
marketed, based upon patents issued
to Herbert Knight of New York. Instead to Herbert Knight of New York. Instead of simply turning the ground over, the new implement shatters it, the pulversing being accomplished by a series of explosions that takes place below the surface. The plow is propoled by a gasolish motor, the exhaust gases from which are convered through a suitable pipe into hollow cultivator teeth which extend into hollow cultivator teeth which extend into the soil The lower ends of these teeth have suitable openings, through which the games discharge with detonating force. The ground is thoroughly broken, the weeds torn out, and the earth left in a fluiry and highly serated state. The in a nury and highly aerated state. The detonating gases are unally earbon dioxide, water vapor, oxygen and nitrogen, all beneficial to plant growth. The force of the explosions destroys fund, undesirable shimal life, eggs and larvae.

Convenience for the Smoker

A VERY complete and handy match box holder has recently been in vented by E. R. Ganson of Columbus Ohio. It is manufactured in two sises. the smaller for safety matches and the larger, as illustrated, for double-tip matches. Both sizes have fireproof recepmatches. Both alses have fireproof recep-tacles of mulge isse for the recytling of burnt matches, as well as fireproof ash trus, libit are adapted for mounting upon any vortical, burizacital or luclined surface, or to set loosely upon a horizon-case or counter. The small size is admir-ably suited for mounting upon the in-strument board or whidshield of an auti-strument board or whidshield of an autimobile An empty box can be removed from the holder and a full box substiiron the sholer and a rule roce superiority tuted in less time than it takes to tell about it 'The match box itself is held securely in the most convenient half-open position, and does not have to be broken out at one send to facilitate the removal of matches. Both holders are made of



The electric vaporiser for medicated

Methods of Measuring the Proper-ties of Electrical Insulating Materials

SCIENTIFIC Paper No. 471 of the Bu-reau of Standards which can be ob-tained from the Superintendent of Docu-ments, Government Printing Office, Wash ington, D. C., at 15 cents a copy, desorthes methods of measuring the prop-erties of electrical insulating materials. This paper gives a series of electrical, This paper gives a sarries of electrical, thermal, cheurical and mechanical test methods which have been found useful in the study of solid electrical translating are those used in obtaining the data witted "Properties of Electrical Englanders of the Dureau of Stanfards estilled "Properties of Electrical Englanders of the Electrical Englanders of the Electrical Englanders of the Electrical Electrical Englanders of the Electrical Electr sistivity, tensite strength, movitum or classicity (tensite), proportional limit, modulus of rupture, modulus of elasticity (transverse). Brinell hardness, sciences, sciences, resistance to liminet, permanent distortion, density, moisture absorption, machining qualities, thermal expansivity, and the effects of hest, acid and alkali.

The methods and apparatus are de-scribed in some detail first, so that the data in Technologic Paper No 216 will be definite and be capable of being correctly compared with other data, second, so that any of the tests may be repro-duced by others.

Tests of Radio Receiving Sets

THE results of tests of radio receiving given in a series of Letter Circulars, the first one of which (No. 90) was issued a few weeks ago. This paper dealt with tests of electron tube sets. The second circular of this series (No 83) is now

ready for distribution and gives the re-sults of tests on crystal detector sets. It is believed that the methods followed and the examples given in their reports will be of assistance to manufa



Fresh and burnt matches and sakes are all taken care of by this heider

turers in the development of methods of testing besides aiding them to properly describe and improve their products. The ionment of methods of particular receiving sets are referred to particular receiving sets are referred to by arbitrary reference numbers rather than by manufacturer's name and type and model numbers. As these circulars are available only in mimographed form, the supply is limited but copies can be obtained by those directly con-cerned with the testing of receiving sets by addressing request to the Bureau of

An Indoor Draft for the Kitchen Range

With the spharatus of the accom-panying drawing one of the ordi-nary stove holes in the top of the kitchen range may be used to secure an improve draft and a hotter fire. The "hot blas feeder, ' as its inventor calls it, takes the place of the stove lid, and he emphasizes that it doesn't occupy any more space than a cooking kettle, and is more orna-

The idea of the hot blast is to have an The idea of the not best is to have an extremely hot nucleus in the fire, immediately below the discharge point of the apparatus. The fushion in which it achieves this is self-explanatory. An adachieves this is self-explanatory. An addittonal function may be got from it
when slick or powdered coal is burned.
The cilinder of the blast outfit, around
the draft tube, may be filled with such
material and will act as an automatic
auxiliary feeder, insuring a continual
supply of highly combustible test at the
hot spot of the fire. This does not, of hot spot of the fire This does not, or course, replace hand stoking of the store entirely, it is simply an auxiliary ar-rangement, looking toward making the hot focal point of the fire even hotter than it would be possible to have it with the blost alone



The hot blast device for making the kitchen fire hotter



The driving light that can be instantly thrown, and held, upon any point of the road or the surround ing country

The Light that Shines Where It is Needed

FOR open or closed cars, the driving I light which we illustrate gives a cer-tainty of performance and an case of operation which, the manufacturer says, can only be appreciated through actual use The light is instantly rotatable to any point on a sphere, and will remain fixed in any position on the roughest road. The means for thus moving it is the control handle which is seen projecting from the frame of the car toward the driver. The slightest touch usen this handle changes the light from its nor mai position of straight shead, to the mal position of straight ahead, to the ditch giving perfect illumination for the driver at the point where he needs it must be pushing, while at the same time extending to the approaching, or abso-lute freedom from giare. For electic switch is at the base of the control han-dle, in such a position that the thumb rests naturally upon it in grapping the bandle, results and the property of the prohandle, permitting a quickness of turning on and off new r before attained. It gives a combination of the spotlight and the driving light which should be of the greatest value to all who are obliged to drive extensively at night

Smooth Starting for Steam Trains

DETAILED description of the im DETAILED description or the improvement in rullroad couplings patented by Mr E. W. Brown of Lancaster Pa, would be out of place suce in a rullroad magnatise, but a statement of what it does and in a general way how it does it abould be of general interhow it does it abould be of general inter-oat. Everybody who ever rides on a steam train knows how the curs bump-and jerk in starting, while the sinch in the couplings is being taken up, and how the entire train heaves and buckles as each coupling straightens out, takes up its load, and gives the first yank to the ear behind it Mr Brown would equip our cars with central longitudinal girders or frames, running from coupler to

coupler These frames would have a cer-tain amount of play under the car, for which the inventor has made ingenious provision When the engine gives its first forward impulse, the first coupling would forward impulse, the first coupling would go with it, as always, but instead of bringing the first car along, this would marely move the sliding girder-frame for-ward sufficiently to take up the slack of cond coupling With this coupling the second coupling With this coupling in play, the same thing would happen under the next car, and the next, and none of the cars would tend to more forward at all until all the couplings were taut. Then the rear car couplings were taut. Then the rear car would get the pull, would have no car behind to which to transfer it, and would start to roll forward, bringing the entire train into motion without jars or

A Novel Demonstration

A sutomobile's lubrication, in some measure at least depends upon gravity to make the oil flow over the lubricated surfaces, and this is true of cars having the most elaborate force-feed oiling in only less measure than of those relving upon the simple splash. So when a prospective purchaser lives in mountain country, it is a pertinent question for him to ask what effect continual running on heavy grades is going



The automatic fender for cars and trucks, in driving and dropped positions

An Automatic Safety Fender

IT has long been contended that the persons' being struck by automobiles and trucks could be materially decreased by the invention of some sort of fender which would keep the victim of the acci which would keep the victim of the acci-dent from rolling under the wheels of the vehicle. In nearly every instance where death has occurred as a result of accidents of this nature it has been due accidents of this nature it has been due to the fact that the person struck has been run over by the wheels before the vehicle could be brought to a stop. A countless number of safety devices

has been developed that claimed to work



To prove that the oiling system would function under the severest handicaps, this demonstration car was run under its own power in the condition shows

to have on the lubrication system of

A Sun Francisco agent for one of the popular lighter sixes recently staged a very clever demonstration covering this ground. As our illustration shows, he built a false bottom under the front end of his car, of such height as to tilt the machine to an angle of 32 degrees. With a steering gear that had been sufficiently tumpered with to make the feat possible, he drove this fearfully up-tilted car for many days and many miles through the streets of San Francisco and Oukland, ulwars under its own power The com-plete failure of the oiling system to give the slightest trouble under this severe test is offered as proof positive that the car will get oil wherever it can go in California's mountains,

to this end. A recent one is of unusually to this end. A recent one is of unurnally simple construction, consisting of a bumper, a horizontal trip ber and an au tomatic fender. The trip ber is located an inch or two in front of the fender when driving, and the instant the person is struck, it releases the fender, which is struck it releases the renger, which adopt to the ground und, by pushing him along in front of them, prevents the person's being crushed beneath the wheels. It is said to be impossible for the victim to get beneath the wheels of the vehicle, and the most extensive tests have served to bear out this contention, the fende never falling to operate. When a body is struck the fender auto

never failing to operation.

The failing to operation the funder authorized the processes and frops to the ground, thus pushing the body absed of the truck and making it inpressible for whicks. The driver has his hands free to stop the which, is not required to lift a finger to operate the fender and seed to the state of the sta

A Means for Increasing the Efficiency of Haddinters

In the last issue of the SCHRYSTAN

AMERICA, mention was made of tests in progress at the Bureau of Standards on the emissivity of sheet iron covered

with white paint, glass unamel, alumi-num paint, etc. These tests are of inter-est in connection with the question of hent radiated from the under side of nent raunced iron the unow most or roofing material, etc., when expend to the sun. Data were given showing that a coating of sluminum paint emitted eally 2T to 30 per cent as much as white paint, glass enamel, or other nonmetallic

surfaces.
The application of this information to the painting of radiators for beating houses is obvious. But the gain in heating, by covering the surface with a non-metallic paint, is not two to three times that of the aluminum paint, as might be inferred from the above-mentioned data. This is owing to the fact that an ordination of the painting to the fact that an ordination of the fact that are ordinated to the fact that an ordination of the fact that are ordinated to the fact that an ordination of the fact that are ordinated to the fact that are ordinated that are ordinated to the fact that are ordinated to the fact that are ordinated that are ordinated to the fact that are ordinated to the fact that This is owing to the fact that an ordi-nary steam radiator is cellular in struc-ture, which facilitates heating of the sir-by conduction and convection. The heat radiated from the sides is relatively of

radiated from the success is remaining we secondary importance. Previous publications on this subject. (Allea, Riecitical World, 57, p. 1616, June 22, 1911, and Jour Am Soc Hest-ing and Ventil, Bug., 26, p. 305, 1920) in-dicate that a radiator coated with alumidicate that a radiator coated with adminuum paint emits only about 80 per cent as much as a radiator which is enameled or covered with a nonmetallic paint.

In other words, we may expect a gain

In other words, we may expect a gain of 15 to 20 per cent in heat dissipation by using a nonmetallic covering on ord-nary house radiators. This is worth con-sidering. The nonmetallic coating can be sidering. The nonmerance coating can be painted over the aluminum paint (if the radiator happens to have a coat of alu-minum) which is a good conductor of heat and bence does not impede thermal conduction through the walls of the

The Talking Glove
The curious glove which we illustrate
Therewith has two uses, The letters
are marked upon it in the positions of are marked upon it in the positions of one of the standard alphabets wherewith deaf-and-dumb people talk among them-selves with such incredible speed. One learning the alphabet and its use may wear the given for guidance until he ac-quires facility; and one who does not





Looking down upon the running year of a railroad coach, equipped with the apparatus that allows the couplings of successive cars to play against ose another until the slack is taken up, so that the train may start without jurking



expect to learn it, but who must talk with a deaf-and-dumb person, may use it as a guide for his own speech and a means of translation of what is said to him. The betters are arranged, it will be noted, in a manner not entirely dissingular to the universal typewriter key-

A Simple Luggage Carrier

A Simple Laggage Carrier
A N unusually effective laggage carrier
A has just been put out from North
Tunawands, N Y. As our photograph
indicates, without making the medias
provides means for strapping with the
ulmost security to the running board
anything of such size that the running
concluding this constrat in the main of
metal strip, extending occurs the running board from the inside to the outside edge, At the inside days it is semeans of a long boil and a wing-sut At
the outside, the weight of the luggage means or a long post and a wing-nut At the outside, the weight of the luggage which it curries holds it down. All along this strip there are oblong holes, into any of which the outer strap snaps with any of which the outer army snaps with a snaffle hole. The inner strap snaps similarly into the upper end of the bolt member. The two straps are the brought around over the baggage, drawn as tant as may be, and buckled together Photographs are shown us of a full-sized Photographs are shown us of a full-sized staneare truth carried in this way for the stanear truth carried in this way for on end, to heave the floor clear, and an outif of hagages and came quelquiesset in nine pieces carried over 5.000 miles. In the latter case, thur of the units were two seens always pienty. In any case, as many may be mounted as the exigencies of the situation demand, and the baggare is carried with complete security isthe words of the manufacture is for the time part of the car

Each Coll a New Fuse

SOMETHING new in the way of re-newable fuses has just been put out, and is illustrated herewith. The six colls and is illustrated herewith. The mx cous of whe in the device represent six fuses, any one of which is immediately ready for connecting to the terminal after it has been straightened out. These, coils



he nevert renevable free outfit.

are of standard fuse composition We show the fuse with one coil straightened out and attached to the binding post, and the others waiting to be used in turn.

The All-Around Band Saw All Conference of the season's noveties in the for cutting wood and metal, just out by a Wiscondan manufacturer It is chimed to be the only portable meal-cutting band new on the market, and the only both wood und metal. The lituaration gives a good idea of the general character of this new Special features worthy of mention include bail bearings every for mention include bail bearings are perfect allocated. Tension on the analysis of the season of th The All-Around Band Saw

Spring Hangers That Are Different

ONE of the points where Tin Linde comes in for much abuse—both verbal and operating—is the front spring verbal and operating—is the front spring shackles. It almost seems as though the average driver had no realization at all front half of his ear is suspended from the springs by these four little members. It whether he be inclined to do his ought to find greater riding comfort with the suspension liberaried. This, is will be observed, substitutes for the single pair of the control of the spring pair of the stage. duplex effect, and it has a little auxil tary soring between the two points at



Making the baggage part of the car

which suspension is effected. The result is claimed to be a vastly better cushion-ing; and it certainly looks plausible

New Use for Mosses Traps

A COORDING to the United States DeApartment of Agriculture, the mouse
trap has a new Government bib. Find
coumfitting sections depredations on the
immature cora and musage bears proving
in the experimental plate of the Federal
to wary to est poinced grain, the
mouse trap was called into service. In
the corn plate, the traps were wided to
apply to est poinced grain, the
mouse trap was called into service. In
the corn plate, the traps when
the trap was called into service, the
service of the control of the corn
to wary to est poinced grain, the
mouse trap was called into service.

It is corn plate, the traps when
the corn plate of the corn
to warp to the plate of the
traps are
also bailed with soft corn and laid on
the ground search plants. New Use for Mouse Traps

The Latest Stream-Lined Car

FROM Berlin, the home of the streama lined automobile, there comes forth every now and then a brand new shape in which this idea is worked out in a different fashion. The very latest exam-ple looks a good deal like the domicile of the old woman who lived in a shoe, until one gets the proper mental and optical slant upon it to realize that it is really an automobile. In keeping with modern doctrine that the stream lining of the rear is of more vital importance than that of the front, the long wedge-shaped profile presented by this car is the stern, prow is comparatively blunt The disk pattern, apparently with no attempt to stream line their profile, which night seem a fatal omission. Our photographet assures us, however, that the weird ve hicle has great speed—and, of cou that it "has taken years to perfect."



nevel spring suspension for the front system of the flivver

How Strong Are Hollow-Tile Walls?

Walls?

IN a series of tests made by the Bureau of Standards in a 10,000,000pound hydraulic testing mealine, and deseribed in Technological Paper No 288
feeding time the testing mealine, and terelay tiles twelve inches long, twelve
inches wide and either six, eight or
twelve inches thick were tested to the
point of failure. These tiles were first
was found to be much greater than that of
those usually used in building construction. Their design was such that all the
next many than the wall. Owing for the
fact that the walls over curvally. ct that the walls were very o set by an experienced mason they are considered to have been stronger than those usually used in buildings.

Of the thirty two walls which were cells of the tile vertical and the other half with them horizontal. A few walls of each construction were trated under an eccentric load two inches off center It was found that considerable differ-

nces in the strength of the tile did not e an appreciable effect on the night of the walls. No relation was found between the ultimate strength and the load at first crack. Walls having the cells of the tile vertical had on the aver age, more than twice the strength of having the cells horizontal those having the cells horizontal Walls louded with an eccentricity of two inches had about one-half the strength of simi-lar walls axially loaded Apparently this ratio is independent of the thickness of

An Electrically Lighted Gas Fur-nace in the Floor

A N electrically lighted, fully vented gas floor-furnace is now offered, in which the entire control and lighting apparatus act as one. When the gas is which the entire control and lighting ap-paratus act as one When the gas is turned full on, an electrical contact (low tension) is formed which gives a spark (high tension) in the plug. Lighting is thus positive and inetant, without the use of plot or matches. This should not be confused with the ordinary "electric to the confused with the ordinary "electric



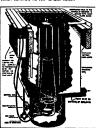
Stream-lining in its latest form

push button control' which co a magnet valve and requires a pilot light to be burning constantly

to be burning constantly
The electric current is supplied by a
four-cell dry battery and a standard
spark coil. The spark plug is in a cast
tron chamber and does not come in contact with the fiame. If so desired, the
buttery may be eliminated by connecting
the spark coil to a bell-ringing transformer of the proper size. ormer of the proper size,
This gas furnace has many safety fea

This gas furnace has many safety fee ures. It has no dangerous pilet light, and the products of combustion are absolutely sealed from the room at, being solution sealed from the room at, being solution and the season of the construction is such that it may be deliberately filled with gas and thesi go deliberately filled with gas and thesi go portant feature is due to the entirely open design of base of the combustion chamber. The fanne cannot be blown out by a down draught or back draught is combustion chamber and the fanne cannot be blown out by a down draught or back draught is combustion chamber and chamber and the fanne cannot be though out of the combustion of the fanne cannot be therefore. the nue, as it burns within a cone-snaped combustion chamber and is, therefore, isolated from any side droughts. The ef-fects of a back drought are cured for by the small safety vent holes in the lower portion, just below the flue outlet. In event of back draught the "dead air seal' drops slightly, thus uncovering the safety vent holes and allowing the backed up fumes to escape through them without smothering the flame Should the gas be turned on deliberately without lighting it, there is no danger of its en tering the rooms. There is no danger of fire, the box, insulated with asbestos, may be placed snug against the wood joints without the least danger—the box remains cool on account of the cold air intake space entirely surrounding the hot radiator. The furnace is so simple and fool proof that a child can safely

The furnace is unusually economical in its operation—high efficiency being ob-tained by the method of passing the hot gases through wide, ribbon like corrugations instead of the usual tubes



The fool-proof gas furnace to be in-stalled beneath the floor

The Motor-Driven Commercial Vehicle

oted by MAJOR VIOTOR W PAGE M. S. A. R.

This department is devoted to the interests of present and prospective owners of motor trucks and delivery suggests. The editor will endeavor to assurer any question relating to mechanical features, operation and management of commercial motor vehicles

The battery tray moved out for in-spection of the cells



New electric truck chassis, showing accessible carrying boxes for batteries, asspended on their own springs to reduce shock

Electric Truck with Novel

Battery Suspension
MONG the senson's new offerings is
an electric motor truck in which the construction has in numerous ways been simplified to promote case of operation and accessibility of all of the important units. The choosis is designed as a comunits. The thissis is designed as a com-plete unit, with no part of it depending on the body. The dash, fenders, sents, etc., are included in the chassis price. The electric driving motor is mounted under the seat. It is hung in a heavy cross member, which also serves as a ort for the front end of the battery The motor is connected to the rear axie through a three-joint propeller shaft, which is supported in the center by a self alining bearing

The outsignding feature of the new truck is the battery suspension. A slid-ing tray is provided by means of which the battery trays are mounted in a sin gle master tray, which is on rollers in the cradic, and can be moved, without auxiliary apparatus, into a position where all of the cells of the battery can be reached for flushing or other attention It is unnecessary to break any electrical connections to do this work, and the door of the battery box serves as a lock door of the battery hox serves as a lock for the sliding tray. Means are provided for stopping the tray at the end of its truvel, but these stops are easily de-tuched when it is necessary to remove the entire tray from the truck. There-fore, for emphasization that the prothe entire tray room the truck Inter-fore, for complete replacement purposes, the battery can be removed easily in two sections and a fresh battery sub-stituted. The trays and compartments will accommodate regular and overdise batteries for the various models. Any stundard battery can be installed.

standard battery can be installed.

It is difficult to design a structure successfully to carry such a highly concentrated load as a battery. For convenience in manipulation and to make all of the car platform space available for pay load, this mass should be hung beneath the frame Such a construction brings the center of gravity of the battery close to the ground. With this relationship, it is not possible for the conventional springs to function properly in cushion ng the battery and frame against books, and the normal accelerations shocks, and the normal secelerations and relarghtions from a rough road set up heavy breames, both in the battery and its supporting frame. These streams are multiplied many times when the truck backs up against a platform or curb. In the new electric this problem is in links to permit movement in the direc-tion of the motion of the car, and with this movement opposed by springs, quite distinct from the chassis springs, a con-struction is obtained which eliminates due to this suspen

The new electric truck is unusual in other respects, not the least of which is the fact that it is put out by a concern that has for years manufactured gase-line trucks. The lond-carrying elements of the chassis are of the same design and

construction which have been tested by years of successful operation of these s-driven vehicles is possible to in It is no stall a body with to the ground, so that the loud can be handled easily The chassis is designed as a complete unit, with no part of it depending on the



at rest. It is also possible to reverse the motor for emergency braking—a fea-ture unique to the electric truck,

A Self-Contained Kerosene

THE fuel situation is more acute in England than it is in this country, as it is necessary to import the greater part of the fuel used in automobiles because of the fuel used in automobiles because there are no local sources of supply, if one is to except the shale derivatives and bensol, neither of which is produced in sufficient quantities to supply even a small part of the demand. For that ressmall part of the demand. For that rea-son, English truck designers continue their experiments with devices intended to burn lower grade fucks corresponding to what is sold in this country as

A kerosens vaporiser operating on the partial combustion principle is use certain trucks and was recently illus-trated and described in our English con-temporary, Engineering The device is considerably smaller than other kerosene carburetors and is self-contained, that is, it does not require so-called hot-spot or exhaust-heated manifolds. The kerosme tank is connected to the carbo s is connected to the carburetor in-s, and is controlled by an ordinary carburetor float. From the float chamber the fuel travels into a passage in the body of the main casting, to which are connected a main jet and an auxiliary jet The main jet terminates just above the level at which the float valve main tains the oil, but the fluid rises through the auxiliary jet into the bottom of a small secondary chamber. Fitting into the bottom of which is pierced with a number of holes, each of which is filled by an asbestos wick. The lower ends of these wicks dip into the kerosene in the secondary chamber

To start the engine from the dead old condition, the carburetor cover is removed, by loosening the wing-nut which holds it, so that air has free access to the inside of the wick casting. A creas to the inside of the wick casting. A high tension spark is then passed from the spark plug to a piece of metal sur-rounding the wick directly beneath the plug. This ignites the wicks, which are allowed to burn for a minute or so, to warm the casting. The cover is then re-placed and the engine is ready to be started The spark is again switched on and the engine cranked round. The operation of cranking draws air through a and plate, which is perforated with oles. This air is separated into two ortions. One passes directly down.

through the curved pipe and upward past the end of the main fuel jet. This main rue jet. This
is the main vaporising air which draws
the kerosene out of
the jet and carries it upward in the por and spray

The other portion of the air is led to an annular space surrounding the passes into the inte-rior of this casting is small holes drilled

through its walls. The presence of this air keeps the wicks burning after they have been lighted by the spark. A small have been lighted by the spark. A small part of the heated products of combus-tion passes upward, mixing with the pure incoming air to raise its tempera-ture. The major part, however, passes out at a very high temperature, meets the kerosene spray as it emerges from

ture and forces the vapor into contact with the walls at a point where they are maintained at a bigh temperature by the hot gas or fame surrounding them. The mixture, and the additional air required for combustion, are controlled by sepfor continuous, are controlled by separate butterfly valves, so connected that a richer mixture is automatically provided when the engine is "idling," and the mixture strength may also be increased above the normal under overload

It is claimed that the engine can be started within a minute or so from cold, without the use of gasoline or any means of auxiliary heating. As soon as the engine is firing, the spark in the vaporiser is switched off, as the passage of air over the wicks is then sufficient to keep them slight. Should they be blown ou by a buckfire, or become extinguished from any other cause, they can be instantly reignited by switching on the curburetor spark momentarily When the engine has been running long enough to heat the water in the radiator appre-ciably, it may be stopped and restarted by ordinary cranking after an interval amounting to as much as a couple of hours, without removing the cover of the curburator

Crawler-Traction Member for Wheeled Tractor

UST as soon as any automotive product is marketed in sufficient quanti ties so that its distribution is general, then other manufacturers devise attachments to increase the usefulness of the machine or to adapt it for certain work that it would not perform so creditably by itself. An attachment that is said to double the drawbar pull of a well known light tractor of the wheeled type that is made in large quantities, operates on the "crawler" principle and is de-signed to replace the traction wheels or dinarily supplied by the manufacturer less to may, these traction men Needless to my, these traction members provide much more ground contact than wheels and can be used in soft and bogy soil where wheels, even with lugs and extension rims, would be at a marked disadvantage. Two widths of track are availible, inhesized, for use on hard ground, and twelve-inch, for soft places where more ground sumport is needed. where more ground support is needed. The widest type has pressed steel grout The widest type has pressed steel grouters riveted to manganess steel links to increase the traction. It is stated that the attachment can be installed in place of the wheels in about an hour



Plowing an asphalt street with a whooled tractor, equipped with special

Recently Patented Inventions

Brief Descriptions of Newly Invented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Agrenantics

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of the plane.

AIRPLANE—J S. SART, Pale Mani,
Territory of Hawait. The invention relates
to an adplane that is supported in the air
to an adplane that is supported in the air
The essential part of the invention is the
propolar which is not arranged to rely on
the air for a reacting means, its purpose
the sit for a reacting means, the purpose
in such a manner that the tips of the bindes
engage the water surface as a reacting
meant. (See Fig. 1)

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vice may be applicable to heads of various
stans.

RENEWABLE PRIMARY DRY-CELL RNNEWARDS PRIMARY DRYCELL BATTERY - W. S. Doz, c/o Dec Electrical Duries Co., Kant, Ohlo. The object of the investion is to provide a remarkable dryceal investion is to provide a remarkable dryceal depolariser and excitant or the size element, and reassemble the parts to again have an effective bettery the same as originally placed on the market, the battery is exceedingly serviceable for use in self-contained destricts.

3.-WHAT MAY BE PATENTED?

3.—WHAT MAY BE PATENTED?

UNDER the conditation of the United States the Congress has been given been to present the presence of science and the unrift acts by granting for limited periods to intentors the exclusive right to their discoveries. Accordingly, under our distutes any person who has invested or master may be granted a patient interview by discovery in seast invention, and the term is not used in its generic or breader sense. Likewise the word agridies a process. In all probability the great majority of patients granted are for machines or other mechanical structures. Almost any machine when reserved into the completes particularly and the structure of the complete particular of the structure of the s

Another object is to permit the use of the controlling derice without the use of the term of the controlling derice without the use of the derice wherever it is desired to actuate the use of the Controlling derice with the controlling derice with the controlling derice with the like the controlling derice with the controlling derice wit

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effective measures the parts to again have an interest for emporting the lamy globe with effective battery the same as originally placed TLAMP PIXTURE AND SOCIETY COMservicesho for use to self-centiated electric species, and the self-cential control of the self-cential cential ce

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Of General Interest

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Fig. 2. The invention by which A. Hey





Fig 5. Keeping the window-washer's arm dry with J P Kelly's invention



Fig. C. J. R. Starch's version of the jowelry clear that opens easily when desired, and not not all when und



Fig. 7. Better cushioning of the shock of impact is the claim made by W. G. Bell for this cretch to



Fig. 8. Collegelble crute for shipping five stock, invented by J. W. O. Orbin

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REPARE DEFYCE FOR FISHING
RODS—D McC Horsow, Band, Oregon
The primary object of the invention is no
provide means by which regains to fishing
the provide means by which regains to fishing
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whereby the tips, ferrules, and the like, of
fishing rods and similar articles may be
accuracy fastened in place in such a meaner
where how may be readily removed when dewired key may be readily removed when dewired key may be readily removed when de-

BOTTLE CAP REMOVER.-T C RUSH MUTTLE CAP PRIMOVER.—TO RUSH, CO Hay Hardware Co. Excington, Ky. An construction which may be readily attached construction which may be readily attached to a support and positioned in such man-ner that, when not in use, it will occupy a minimum space and form no outwardly ex-ception of the construction of the con-devices, respectively.

cobject of the invention is to provide a hottle content of the invention of the private pripare and the content of the private pripare and the provided in an import and positioned in such as ordinary gather on the dash cutture such as ordinary gather or the dash cutture gather of the such gather of the such gather of the such gather of the such gather of the cutture which distincts the measuring of typic gather was a gather gather of a waterproof case support of a waterproof case suppost of the threat of the such gather of the cutture which distincts the measuring of typic gather gather of the such gather of the cutter which colors to the total cutter which colors and colors of the private gather of the private gather of the private gather of the private gather as the private gather gath

Fig. 1, H. Blender, requires of the horself to the control of the

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of the weater. (See Fig. 8.)
COMES—S. B. Howans, Geleonda, Nev
The object of this invention is to provide
a comb construction in such manner that
the teeth are sailly separable to permit an
sailly separable to permit the
teeth are seen on the complex and the
sailly separable to the sailly separable
therefore. The comb is simple and inceptastate to manufacture. (See Fig. 160)

Hardware and Tools

Eardware and Tools

ROASTRING PURNACH. J. TROMAS,
2104; W. Heres St., Abarden. Wash. The
travetion alone to provide a reading furnace
which may be operated by any desirable type
device which may be resultly portable, and
in which the construction is simple, provided
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sective.

BTERING COMPRESSOR.—C. A. Passcorr, 147 Elwardie Ave., Providence, R. I.
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resolving spindle out of the body, the work receiving spindle being rotated on ball bear returns on the property of the proper

trolling the temperature by this precess. FIRE KINDENI—J Outry, 565 Herard SE, Detroit, Mich. This invention return of the period of the period of the contraction of the control of the control of the contraction of the control of the control of the contraction of the control of the control of the contraction of the control of the control of the contraction of the control of the control of the contraction of the control of the control of the contraction of the control of the control of the contraction of the control of the control of the contraction of the control of the con
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exeriod in operating
FLUSHING VALVE. — W 8 Whrra,
Denver, Col The invention has for its object to provide a valve which comprises a
piston and a pendant valve movable vertiand a pendant valve movable vertibeing that the flow of flushing water will not
cause the value to bind. The device also
includes an anxiliary valve for venting a
chamber above the piston

chamber above the piston
HAIR WAVING MACHINE. — J M
HIGHMAR, 1223 15th St., Sacramento, Cellif.
The particular object of the invantion is to
provide a machine that will enable a person
in a very above time, without the assistance
of an attradant, and without the exercise
of any particular skill. The device is simple
and will produce the required wave in a few
minutes.

minutes.
PUMPING POWER.—F. 8 Staar, Ship-poulli, Pa The investion relates note and the poulli, Pa The investion relates note at the pumping power. An important object is to provide a pumping power which comploys an extremely heavy has into which comploys and extremely havy has into which comploys and the provided power with the power of the provided power of the power of the provided power of the provided power of the po

Medical Devices

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Fig. 10. R. B. Howard's comb with

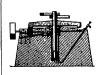


Fig. 11. E. S. Sinon has patented this be arrangement for pumping in all wells



Fig. 13 Improved instrument for reme tensils, the invention of O. C. Daniels



Fig. 18. Axis-alining radius-leaf adj



Fig. 14. W E. Hodger's tire val



Fig.-15. Attachment by means of which E. E. Proston is able to relieve the feet on the



Fig. 16. Novel style of hyske-band Halag in-ventrel by R. Reynolds

Musical Devices

Musical Devices

MUSIC ROLL CONTAINER.—R. V
O NELLI, 1859 Westchnettr Ave, Broox, N
This investion sevia for its principal
object to provide a container for music rolls
which inculate a means to permit the play
ing of the role without removing the same
ac container which inculses means for reducing friction to a minimum, and preventing weer on the container proper

ducing friction to a minimum, and preventing wear on the container proper MIRSIGAL NOTE-SINDICATING AT MIRSIGAL NOTE-SINDICATING AT MIRSIGAL NOTE-SINDICATING AT MIRSIGAL NOTE-SINDICATING AT MIRSIGAL NOTE AND A STATE OF THE SINDICATION OF THE or notes in connec ment is operated.

Prime Movers and Their Accessories.

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IVI, Mo. The Invention sine to provide
a labricating system for use in connection
with internal combation engines by invense
ply in such monner that just the correct
amount of labricant will be utilised and
evenly distributed so that nil of the object
tions in this eminection will be willied and
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COMMINEST COOLING AND CAS. Prime Movers and Their Accessories

as nominal figure

COMBINED COOLING AND CABBUMPING SYSTEM FOR INTERNAL

COMBINED KNOINES—A CABBUMPING SYSTEM FOR INTERNAL

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ACYELERATOR.—C HAMMOND and W
IMMAN, Boyne City Mich The Invention
rulers to receiverstors for use on internal
combustion engines. Briefly stated the obmotors had ing means whereby the same is
operated automatically by the depression of
either the clutch or raverse pedials, the
device may be applied without elaborately
sitering the construction of the augine.

aftering the construction of the angine.

CLC N IN G IMPLEWIBERT — G A
HOYE, Leanep Mont The sim of this in
vention is to provide a device particularly
ing of spark place and by means of which
an operator will be enabled to effectively
clean all of the parts of the play without
going to the necessity of dis-assembling the
sum. The device is extremely simple and
GAS WORLING.— Of Mercon, do, by. D.
GAS WORLING.— Of Mercon, do, by. D.

can be manufactured at a nominal figure AAB ENGINE—O NITAGE '40 PT D' P Teter, 2000 Irvius Park Bidg. Chicage, the provide a slapple and efficient timing means to provide a slapple and efficient timing means to provide a slapple and efficient timing means taken of assass for drawing a full charge to a point—efficient the working cylinder by means cuttisfe of said cylinder, and to pro-vide means for opening and closing the pover of gas engine in desirter relations with each of gas engine in desirter relations with each

spark plug comprising a plurality of electrodes permanently adjusted and arranged to provide a succession of spark gaps which function to intensity the spark in the aggregate and to prevent fouling of the plug.

function to intensity the spark in the aggress and to prevent fouling of the page. To INTING INTEX.—V W Place, Wo Stanford, Com. The Invention relates to internal combestion motors, and percins to internal combestion motors, and percins to internal combestion motors, and percins combestion motors, and percins combestion of the combestion relates to internal combestion motors, and percins classified to the combestion of the chipself and the motor than of the chipself and the combestion of the combestion of the chipself and the season of the combestion of the combes

Railways and Their Access

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Railways and Their Accounting

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It is very a shape in construction and opportune and has no valves other than portune and has no valves other than portune and provide and adapted for diriphanes, motorcycles and ad

Pertaining to Recreation

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apparatus consisting of blooks or personagairs
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faculties in problems of arithmetic and
of chance The game may be played by children or adults and lends Inself to a wide
writely play to exercide the player's inwritely play to exercide the player's inoppity.

genuity,
GAME,—R. Downs, 120 R. Ohio St.,
Chicago, Ill. An object of the invention is
to provide a device in which certain moving
plate are not applied to the property of the company
to the company of the company of the company
ting a dial and an indicator head, both of
which are movable relative to one another
and to the supporting means. The score
may not be precetermined by an unfair
multiplation of the device.

Pertaining to Vehicles

Persisting to vessels to the property of the p

opened and quickly and tightly element LIFFING DEVICES—F of CLIPR, 231 W Adams St., Needeo, Missouri. The gen set object of this invention is to provide an animologie, so constructed as to be adapted or engagement with the frent econ member of the frame for requiring the storring part, the storring part of the case of the frame for requiring the storring part of the case of the contract of the frame for requiring the storring part of the case body in the various necessary operations of repair.

of the care body fa the various necessary operations of regions, 40°, Nerve Break Products Co. 8 Murray St. Banaper, Par This invention relates to a time-indentities a vine, a contact member condenting said ring and member, a collise carrying the ring, a plate certed by the soller and cryman particular content of the collision of the collision

OIL INDICATOR AND FUMP PRIMER—OF Manner, Receively, Unia, in all indicators reserved in the com-mobiles. The general object is to provide an indicator reserved no forest and con-nected up with the pump that oil will be necessary to the property of the pre-dict from the reserved may be returned di-rectly to the pump when required, for pris-ing the latter

ing the latter
AJTO ATTACHMENT—H. D. Coox,
2206 Cleveland Ava, Terre Hauts, Ind.
Among the objects of the investion is to provide a simple attachment for felloss of wheels of ordinary construction which are adapted to set in conjunction with the fall has to neutral of a demonstrable rim being

yssees of ortimary construction which are adapted to act in conjunction with the full angles of the conjunction with the full collect in position or released as quickly for dismonuting therefrom The device is being required in the whole any change sequence of the configuration of t

ment.

RADIUS LEAF—G C. ROSERS, Blowling Block, N. C. The invention relates controlled to the control of the co

(See Fig. 18.)

SAPPITY VALVE AND PRESSURE INDICATOR FOR AUXCOMILLO TURBE.

The Control Form of the Control Form

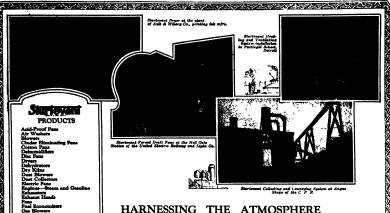
The Invention relates to the air rains for
the inner tubes of time, and the general obpict is to provide a time valve sharing an astime the pumping up of the life and function

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Crossroads of Conversation

Could the telephone directory in the hands of each subscriber be revised from hour to hour, there would be no need for the information operator. But even during its printing and binding, thousands of changes take place in the telephone community. New subscribers are added to the list Old ones move their places of business or of residence.

Though their names are not listed on the directory, these subscribers must be connected by the highways of speech with all others in the community To supplement the printed page, there must be guides at the crossroads of conversation

Such are the information operators, selected for their task because of quickness and accuracy, courtesy and intelligence. At their desks, connected with the switchboards in central offices, they relieve the regular operators from answering thousands of questions about telephone numbers that would otherwise impede the rendering of service. If they are unnecessarily asked for numbers already in the directory, service is retarded.

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ing apparatus amounts to one per cent or the cent of constructing the Imboff tank plant. In the Euhr the receipts from the sale of the gas covers over half of the total operating cents of the Imboff tanks.—Eng News-Record, 91 18, pp. 512-14

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St. Louis is putting Dollars Into Civic Vision

MORE than \$450,000,000 will be spent in St Louis by private enterprises as a result of the city's expenditure of \$87.372,500 for public improvements from bond issue funds. This typifies the spirit of St Louis in which the people are working together for the community's advancement

The railroads have begun an expansion program of \$100,000,000 for new terminal facilities

A new \$15,000,000 electric power plant is in progress.

A \$2,500,000 telephone development is under way.

Industrial extensions of \$35,000,000 have been planned.

The reconstruction of buildings along widened streets and new plazas will total \$300,000,000

This goal was not reached by sitting down and talking it over. The spirit of aggressiveness which is pushing St. Louis forward inspired the people to get to work with collective sincerity. They went to the polls and rolled up an overwhelming majority for bonds to start building a greater St. Louis.

It was this same aggressive spirit which recently brought about the purchase and equipment of a \$200,000 permanent flying field and financing the world's greatest air meet in St Louis

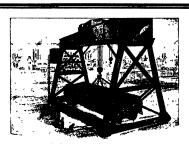
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stories high A third is 153 by 159 feet and is seven stories high. There is also a fourth seven-story building. In addition, there are half a desen five and six story steel buildings. In Yokohama, none exceed three stories.—The Iron Age, 112 11, pp. 635-63.

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91 9 pp. 362-38. The Twe-Strip Highway consists of two 8-foot slabs of concrete with a center strip four feet wide of oil macadam, and two 2 foot shoulders of macadam at the sides. The two-strip type of highway is safer for diving at night because of the plain demarkation of the road — The Highway Mag.

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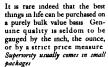
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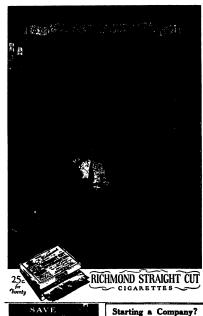
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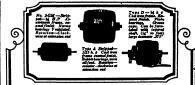


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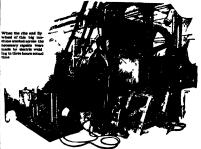
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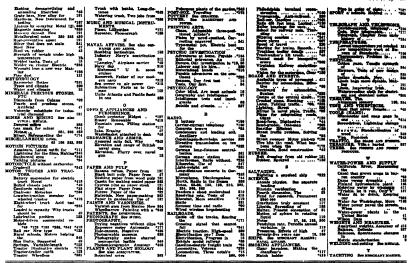
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A chunk of fire strokes the night sky and is gone Where? Swallowed by Friction Literally burned to nothingness, actually worn out of existence, simply by rubbing the air

That's all a "shooting star" is A mass of mostly mineral substance, flung from some whirling body of the skies, hurtling through the airless voids of the universe, until it happens to fly into the layer of air which surrounds our earth

Just rubbing the atmosphere kindles the blazing ball you see, the "shooting star' The friction of just moving through the air is what utterly consumes it

Anything which moves, however fast or slowly, even in the thin

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